Appendix B

Supporting Information for Monitored Facilities

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Supporting Information for Monitored Facilities

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This appendix provides supplemental information for *Resource Conservation and Recovery Act* (RCRA) and other regulated units on the Hanford Site that require groundwater monitoring excluding *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) units (discussed in Appendix A). Site-specific discussions for each facility in Appendix B are found in the body of the document under the respective operable unit in which the facility lies (see Figure 1.0-1 in the main text for operable units).

RCRA groundwater monitoring continued during fiscal year (FY) 2007 at 25 waste management areas (Figure B.1). Estimates of groundwater velocity, hydrologic properties, and associated references are shown in Table B.1 for all RCRA sites. To determine if a waste site has adversely affected groundwater quality under RCRA interim-status regulations (WAC 173-303-400 and by reference, 40 CFR 265.93), concentrations of indicator parameters in downgradient wells are compared to background concentrations. The indicator parameters under interim status are specific conductance, pH, total organic carbon, and total organic halides. The background values to which the indicator parameters are compared are 99% prediction limits, which are calculated for each facility based on samples from upgradient wells. The upper prediction limits also are known as critical mean values.

Critical mean values are recalculated annually or if the number of analyses changes. Annual recalculation accounts for changing background conditions. Changes in the number of analyses are usually the result of changes in monitoring well networks (wells are added or deleted). If changes occur in a monitoring well network, critical mean values for that facility are recalculated for subsequent semiannual sampling events using the new well network.

To reliably indicate potential groundwater effects from a facility, the sample results have to be reasonably precise, or quantifiable. Specific conductance and pH are field measured indicator parameters that are reasonably detectable and quantifiable. The parameters of total organic carbon and total organic halides, however, are much more variable and are often below levels of detection. Significant imprecision and variability occurs when measuring these parameters near detection limits. The variability in laboratory measurements of field blanks are used to estimate laboratory limits of quantitation (LOQ) during the sampling period. The LOQ is defined as ten times the standard deviation of the field blank analyses (see discussion in Section C.7). For detection monitoring the statistical comparison values for total organic carbon and total organic halides are the larger of the critical mean and the LOQ.

Table B.2 lists comparison values (critical mean values and LOQs) used in FY 2007. Additional tables list updated critical mean values for use in FY 2008 for each RCRA unit where these statistics apply. Tables B.3 through B.37 provide supporting information for the RCRA sites and Figures B.2 through B.18 show locations of monitoring wells and regulated units.

This appendix also provides constituent lists, well network configurations, and other ancillary information for regulated facilities that fall outside of RCRA programs except CERCLA units. Some network wells in these facilities are shared with RCRA facilities. Figure B.19 shows the general locations of these facilities. Locations of monitoring wells are shown in Figures B.5, B.15, B.20 and B.21. Tables B.38 through B.44 list the constituents list and/or results summaries for the facilities.

Several RCRA sites continued to have exceedances of critical mean values in FY 2007. Previous assessment studies have shown that the sites have not impacted groundwater with dangerous waste constituents from the facilities. The following sections revisit those conclusions based on recent data.

B.1 Critical Mean Exceedances at 116-N-1 (1301-N) Facility

B.1.1 History

In 1989 downgradient well 199-N-3 exceeded the critical mean value for specific conductance. Assessment studies indicated the exceedance was caused by calcium, sodium, and sulfate that originated at an upgradient facility, the 120-N-1 percolation pond (WHC-SD-EN-EV-003). The site returned to detection monitoring in 1992. To represent groundwater concentrations in the upgradient plume, well 199-N-57 was added to the network. Well 199-N-34 was also monitored as an upgradient well.

B.1.2 FY 2007 Conditions

The high-conductance plume from the 120-N-1 percolation pond is still evident in 100-N Area groundwater. Major ions include sulfate, sodium, calcium, and bicarbonate. The plume has spread to the north over the years (Figure B.22). In the late 1980s and early 1990s, the plume was limited to the area around the 120-N-1 percolation pond and to the north-northwest (see 1990 map in Figure B.22). Groundwater beneath the 116-N-1 and 116-N-3 facilities had very low specific conductance (<200 µS/cm) because the water being discharged to 116-N-3 had low specific conductance. Discharges to the 116-N-3 facility ceased in 1991, and groundwater with higher specific conductance spread northward (see 1996 and 2007 maps in Figure B.22). The core of the high-conductance plume passes to the west of upgradient well 199-N-57, but intersects well 199-N-3. Hence, well 199-N-3 still exceeds the critical mean value that is based on data from wells 199-N-57 and 199-N-34.

Figure B.23 shows trend plots for specific conductance and sulfate in the wells in the 116-N-1 monitoring network. Sulfate is indicative of discharges to the former 120-N-1 percolation pond. As the plume moves downgradient from its source through the aquifer sediments, the groundwater chemistry changes. Sodium and sulfate concentrations drop, while calcium and alkalinity concentrations increase.

B.1.3 Conclusions

The conclusions of the 1992 assessment report (WHC-SD-EN-EV-003) are still valid. The specific conductance exceedances in well 199-N-3 are caused by non-listed constituents including sulfate and sodium from an upgradient facility. There is no evidence that groundwater is adversely impacted by dangerous waste discharges to the 116-N-1 facility. Evidence for these conclusions includes the following:

- ***Effluent Characteristics.*** Discharges to the 116-N-1 facility had low specific conductance. Discharges to the upgradient 120-N-1 percolation pond had high specific conductance and high concentrations of sulfate, sodium, and other ions.
- ***Distribution of Contaminants***. The high-conductance plume from the 120-N-1 percolation pond has spread to the north and the core of the plume intersects well 199-N-3.

The 116-N-1 facility will continue to be monitored under a detection program (PNNL-13914).

B.2 Critical Mean Exceedances at 120-N-1 (1324-NA) Percolation Pond

B.2.1 History

In 1989, all of the downgradient wells monitored for this facility exceeded the critical mean value for specific conductance. Assessment studies indicated the exceedances were caused by non-listed constituents including sodium and sulfate (WHC-SD-EN-EV-003). In 1992 and 1993, total organic halides levels exceeded the critical mean in downgradient wells, and a new assessment program began. That assessment concluded in 1995 and determined that the elevated total organic halides were caused by a nearby facility (WHC-SD-EN-

EV-031). The site returned to detection monitoring. Total organic halides levels are no longer elevated, but specific conductance remains high.

B.2.2 FY 2007 Conditions

All but one of the wells that monitored the 120-N-1 facility in 1989 have gone dry. The remaining well, 199-N-59, and downgradient wells installed in 1991 continue to have elevated specific conductance (Figure B.24). Concentrations of sulfate, sodium, and other ions that were present in the effluent and caused the elevated specific conductance, have declined from their peaks, but remain high.

The high-conductance plume that originated at the 120-N-1 facility is still present beneath the 100-N Area (see Figure B.22).

B.2.3 Conclusions

The conclusions of the 1992 assessment report (WHC-SD-EN-EV-003) are still valid. The exceedances in the downgradient wells are caused by non-listed constituents sulfate and sodium discharged to the site.

The 120-N-1 facility will continue to be monitored under a detection program (PNNL-13914). Groundwater monitoring for the 100-NR-2 Operable Unit continues to monitor the sulfate plume.

B.3 Critical Mean Exceedances at 116-N-3 (1325-N) Facility

B.3.1 History

Samples collected in September 1999 exceeded the revised critical mean value for specific conductance in two downgradient wells (199-N-41 and 199-N-81). A 2000 assessment[a] concluded the exceedances did not indicate that the 116-N-3 facility was contaminating groundwater with hazardous constituents. The high specific conductance is caused by non-listed constituents (i.e., sulfate, calcium) from an upgradient source, the 120-N-1 percolation pond. The site returned to detection monitoring in 2000.

B.3.2 FY 2007 Conditions

The high-conductance plume from the former 120-N-1 percolation pond is still evident in 100-N Area groundwater. It has spread toward the north over the years (see Figure B.22). In the late 1980s and early 1990s, the plume was limited to the area around the 120-N-1 percolation pond and to the north-northwest (see 1990 map in Figure B.22). Groundwater beneath the 116-N-1 and 116-N-3 facilities had very low specific conductance (<200 µS/cm) because the water being discharged to 116-N-3 had low specific conductance. Discharges to the 116-N-3 facility ceased in 1991. The groundwater mound beneath the site dissipated, allowing higher conductance groundwater from the former 120-N-1 pond to flow northward (see 1996 and 2007 maps in Figure B.22).

Figure B.25 shows trend plots for specific conductance and sulfate in wells in the 116-N-3 monitoring network. Sulfate is indicative of discharges to the former 120-N-1 percolation pond. As the plume moves downgradient from its source through the aquifer sediments, the groundwater chemistry changes. Sodium and sulfate concentrations drop, while calcium and alkalinity concentrations increase.

All of the wells are affected by the high-conductance plume. The 2007 critical mean value was fairly low because of low variability in specific conductance in the upgradient well. Specific conductance levels in all the downgradient wells are near or above the 2007 critical mean value.

B.3.3 Conclusions

The conclusions of the 2000 assessment[a] are still valid. The specific conductance exceedances in the downgradient wells are caused by non-listed constituents (sulfate, sodium, and calcium) from an upgradient

(a) Letter from KM Thompson (U.S. Department of Energy, Richland, Washington) to J Hedges (Washington State Department of Ecology), Results of Assessment at the 1325-N Facility, dated July 22, 2000.

facility. There is no evidence that dangerous waste discharges to the 116-N-3 facility have contaminated groundwater. Evidence for these conclusions includes the following:

- ***Effluent Characteristics***. Discharges to the 116-N-3 facility had low specific conductance. Discharges to the upgradient 120-N-1 percolation pond had high specific conductance and high concentrations of sulfate, sodium, and other ions.
- ***Distribution of Contaminants***. The high-conductance plume from the former 120-N-1 percolation pond has spread to the north and affects all of the monitoring wells for the 116-N-3 facility.

The 116-N-3 facility will continue to be monitored under a detection program (PNNL-13914).

B.4. Critical Mean Exceedances at 216-A-29 Ditch

B.4.1 History

Specific conductance exceedance was first observed in downgradient well 299-E25-35 in 1989 (DOE/RL-94-136). This exceedance and the source were subsequently addressed in a groundwater quality assessment in 1995. The assessment report concluded that sulfate was causing elevated specific conductance, and that sulfuric acid discharges to the 216-A-29 ditch was the probable source of the sulfate (WHC-SD-EN-EV-032). Because sulfate is not a listed constituent, it was determined that the site could revert to detection monitoring. Soon after this determination was made, additional wells (e.g., 299-E25-48 and 299-E26-13) began to reflect higher concentrations of sulfate that tracked with specific conductance (Figure B.26).

B.4.2 FY 2007 Conditions

During FY 2007, specific conductance continued to remain above the critical mean in downgradient wells 299-E25-35, 299-E25-48, and 299-E26-13 (see Figure B.26). Sulfate, nitrate, chloride, and the major cations are also rising in these wells. The reason for the exceedances is two-fold: (1) Migration of groundwater containing the higher concentrations of anions initially identified in well 299-E25-35, particularly sulfate, and (2) A low critical mean calculated from the upgradient well in recent years. Figure B.27 shows the trend in critical mean for specific conductance since 1996. Voluminous discharges of raw water to the B Pond facility up to the late 1990s has depressed concentrations of major ions in the region of the upgradient wells, providing for artificially low critical mean values (PNNL-15479). As such, the upgradient wells (699-43-45 and formerly 699-43-43) used for specific conductance critical mean calculations are not representative of natural background. Nitrate and chloride also show upward trends in all the wells monitoring the 216-A-29 ditch, but most of the maximum concentrations are still well below calculations of natural background for these constituents, and all are below primary and secondary drinking water standards.

B.4.3 Conclusions

Groundwater quality assessment performed in 1995 concluded that exceedance of specific conductance critical mean in well 299-E25-35 was due to the non-listed constituents sulfate and sodium. Based on most recent analytical results from FY 2007, this conclusion is still valid, although exceedances have occurred in two additional wells (299-E25-48 and 299-E26-13). This is partially a result of migration of groundwater containing higher anion concentrations and to lowering of the critical mean during the past 10+ years by using an upgradient well with artificially lowered ionic strength. The critical mean for specific conductance at the 216-A-29 ditch for upgradient/downgradient comparisons is currently calculated at 274 µS/cm. This level is well below statistically derived, natural background for this parameter as presented in WHC-EP-0595 (539µS/cm) and DOE-RL-96-61 (614 µS/cm).

B.5. Critical Mean Exceedances at Low-Level Waste Management Area 1

B.5.1 History

Low-Level Waste Management Area (LLWMA) 1 was placed into assessment in January 1990 when specific conductance exceeded the critical mean for this constituent in well 299-E28-26. At that time, well 299-E28-26 was hydraulically downgradient of the facility, but a declining water table has tentatively placed this well upgradient of the facility. The assessment report (WHC-SD-EN-EV-025) concluded that LLWMA-1 had not contributed to groundwater contamination based on the following observations and conditions:

- LLWMA-1 (218-E-10 burial ground) received primarily dry waste with low potential for reaching groundwater.
- Waste disposal at facilities immediately to the south (cribs 216-B-62 and 216-B-55) of LLWMA-1 was consistent with observed groundwater contamination (primarily nitrate). At the time of the assessment report, groundwater flow was reinterpreted to be toward the northwest, placing the cribs immediately upgradient of LLWM-1.
- Wells located south of LLWMA-1 (then upgradient), with longer records of sampling, indicated high nitrate concentrations (up to 170 mg/L).

B.5.2 FY 2007 Conditions

Water levels have continuously declined from ~1990 through the present in all wells in the LLWMA-1 network, primarily because discharges were discontinued at the B Pond facility. This condition has produced at least two effects in groundwater monitoring. The first effect is to reduce the hydraulic gradient across the facility and make determination of groundwater flow direction increasingly difficult based on head differences (see Section 2.10.3.3). The second effect, which is more problematic, is to produce samples that are higher in concentrations of nitrate, sulfate, chloride, and some cations in several wells in the network. The cause of the second effect is probably a combination of three factors:

1. Movement of regional plumes has changed in response to changing head. Plumes may have migrated to produce multiple episodes of increasing or decreasing concentrations. There are some indications that groundwater drainage from the basalt subcrop to the north-northeast may have affected groundwater quality in the northeast corner of LLWMA-1.
2. Early discharges to 200 East Area facilities migrated through the vadose zone to the lower levels of the aquifer. At that time, the saturated thickness of the aquifer was considerably less than it was when groundwater monitoring began in the late 1980s. Now, as the water table declines, the wells are left with a thinner column of water near the bottom of the screened interval, which is also nearer the bottom of the aquifer. Hence, groundwater samples are collected from an increasingly thinner and deeper water column that contains higher chemical concentrations (Figure B.28).
3. Nitrate and cyanide contamination currently detected in wells on the northern and eastern portions of LLWMA-1 is interpreted as originating from the BY cribs and/or Waste Management Area B-BX-BY (see Section 2.10 of main text). These constituents are still generally increasing in concentration in this region (Figure B.29). Nitrate is above the drinking water standard in all but four wells in the LLWMA-1 monitoring network.

B.5.3 Conclusions

Exceedances of the critical mean for specific conductance in LLWMA-1 wells are due primarily to high concentrations of nitrate originating from cribs and other discharge sites in the 200 East Area. A complex combination of sources and changing groundwater flow directions has allowed several contaminant plumes to move into the aquifer beneath LLWMA-1. Contamination from LLWMA-1 is not suspected of contributing to these plumes based on:

- LLWMA-1 (218-E-10 burial ground) received primarily dry waste with low potential for reaching groundwater (PNL-6820; RHO-CD-673).
- Other nearby facilities (e.g., the BY, 216-B-62 and 216-B-55 cribs) and Waste Management Area B-BX-BY have documented discharges of contaminants observed beneath and near LLWMA-1 (e.g., DOE/RL-92-05).
- Historical tracking of contaminant plumes (e.g., nitrate and associated waste constituents) and plume geometries indicate sources to the south, east, and northeast of the LLWMA-1 (e.g., see discussion in Section 2.10.1, DOE/RL-94-136; PNNL-13404; PNNL-16346).

B.6. Critical Mean Exceedances at Low-Level Waste Management Area 4

B.6.1 History

DOE has conducted RCRA groundwater monitoring at LLWMA-4 since 1988 (PNL-6852). At that time, groundwater flow direction was to the west and northwest, due to a lingering effect of the decaying U Pond mound. Carbon tetrachloride contamination in groundwater in the vicinity of LLWMA-4 was recognized since the earliest days of monitoring (e.g., PNL-6852). In upgradient well 299-W18-23, carbon tetrachloride displayed its highest observed concentration at the onset of RCRA monitoring in 1988.

In 1996, the 200-ZP-1 pump-and-treat system began to remove carbon tetrachloride and related constituents (e.g., chloroform and trichloroethene) from groundwater in the 200 West Area. Since then, the system has removed ~11,000 kilograms of carbon tetrachloride (see Section 2.8.2.1). This material has been shown to originate mostly from three facilities: 216-Z-1A tile field, 216-Z-18 crib, and 216-Z-9 trench, east of the LLWMA-4. During the operation of U Pond and other discharges, contamination was driven to the water table beneath some of these facilities and spread over a considerable area, including beneath the LLWMA-4 (DOE/RL-2006-20).

In FY 2002, carbon tetrachloride and other volatile organic compounds were detected in vapor samples collected from the trenches and vadose zone within LLWMA-4. A soil-vapor extraction system was operated at the 218-W-4C burial ground from November 2003 through April 2004. The system removed vapors from the burial ground trench and minimized the release of carbon tetrachloride to the environment. The system removed ~11 kilograms of carbon tetrachloride from trench T-04 in the 218-W-4C burial ground during FY 2004. An update to the results of this activity is presented in Section 3.3.

B.6.2 FY 2007 Conditions

During FY 2007, DOE conducted additional soil vapor extraction in burial ground 218-W-4B (trench 7), where waste retrieval is occurring. Initial vapor sampling results indicated high levels of organic vapor in the vicinity of trenches 7 and 8. Section 3.3, in the main text, discusses this activity in greater detail.

Groundwater pump-and-treat activities continued in the 200-ZP-1 Operable Unit, with six injection wells immediately upgradient of LLWMA-4. Injection of clean water near the upgradient monitoring wells at LLWMA-4 undoubtedly dilutes carbon tetrachloride concentrations in the monitoring wells, which are in the direct lines of flow to extraction wells. Concentrations in all wells in LLWMA-4 continued to decline in FY 2007.

Lines of evidence suggesting carbon tetrachloride sources other than LLWMA-4 include:

- The groundwater flow direction in the 1980s and early 1990s was toward the west and northwest. This placed the known sources (216-Z-1A tile field, 216-Z-18 crib, 216-Z-9 trench) immediately upgradient of the LLWMA-4 wells (see DOE/RL-2007-33; PNL-6852).
- Plume maps from 1990 to 2005 (DOE/RL-2006-20) indicate carbon tetrachloride contamination spreading from areas east of LLWMA-4.

- Recent statistical evaluation of carbon tetrachloride distribution in the 200 West Area (PNNL-16509) predicts that a continuing source of carbon tetrachloride beneath burial grounds 218-W-4B and 218-W4-C is unlikely.
- Modeling of carbon tetrachloride as a dense, nonaqueous phase liquid (PNNL-16198) indicates that undocumented releases of carbon tetrachloride (e.g., LLWMA-4) are not likely sources of the contamination of groundwater.
- Widespread migration of carbon tetrachloride in vapor phase from other sources are known to occur in the vadose zone.

B.6.3 Conclusions

Despite detections and extraction of carbon tetrachloride vapors in trenches 218-W-4C and 218-W-4B, LLWMA-4 is not suspected as a source of chlorinated organics in groundwater. Other nearby sources with documented disposal of large quantities of carbon tetrachloride have spread in the subsurface beneath LLWMA-4 and beyond. Minor, incidental disposal of materials contaminated with carbon tetrachloride may have contributed to vapor detected in LLWMA-4 trenches. Alternatively, all of the vapor may have originated from migration (in vapor, aqueous and/or nonaqueous phases) from other sites.

Injection wells for the 200-ZP-1 pump-and-treat system are currently upgradient of LLWMA-4 upgradient monitoring wells. Injecting clean water lowers concentrations of carbon tetrachloride in these background wells, which produces a lower background comparison value for total organic halides. Stratigraphy, changes in hydraulic head, carbon tetrachloride migration behavior, and disposal activities all dictate a source to the east of LLWMA-4. Retrieval activities and results of a media analyses are currently monitored to determine if this conclusion requires re-evaluation.

B.7 Critical Mean Exceedances at Nonradioactive Dangerous Waste Landfill

B.7.1 History

In 2001, downgradient wells 699-25-34A and 699-25-34B exceeded the critical mean value for specific conductance. Assessment studies indicated the exceedance was caused by increases in the concentrations of non-hazardous constituents (such as calcium and magnesium) from the adjacent 600 Area Central Landfill. Specific conductance at the 600 Area Central Landfill was generally higher than at the Nonradioactive Dangerous Waste Landfill, and there is a known mechanism for the rise in specific conductance (i.e., breakdown of sewage causing elevated carbon dioxide in the vadose zone and elevated specific conductance, calcium, and magnesium in the aquifer beneath). Therefore, the exceedance of the critical mean for specific conductance did not indicate that the Nonradioactive Dangerous Waste Landfill was contaminating groundwater with hazardous constituents. DOE submitted a letter report[b] that served as both the assessment plan and the assessment report. Since then, detection monitoring has continued.

B.7.2 FY 2007 Conditions

Specific conductance (and calcium and magnesium, which are contributors to elevated specific conductance) remain elevated at both the Nonradioactive Dangerous Waste Landfill and the 600 Area Central Landfill. Three wells (699-25-34A, 699-25-34B, and 699-25-34D) continued to exceed the critical mean for specific conductance (594 μS/cm) during FY 2007. The trend for specific conductance at these three wells has been stable since about 2003 (Figure B.30). Levels of specific conductance, calcium, and magnesium remain higher

(b) Letter 01-GWVZ-025 from JG Morse (U.S. Department of Energy, Richland, Washington) to J Hedges (Washington State Department of Ecology), Results of Assessment at the Non-Radioactive Dangerous Waste Landfill (NRDWL), dated June 7, 2001.

at the 600 Area Central Landfill than at the Nonradioactive Dangerous Waste Landfill (Figures B.31, B.32, and B.33). These figures show the following:

- Trends of specific conductance, calcium, and magnesium at the Nonradioactive Dangerous Waste Landfill continue to closely match the trends at the 600 Area Central Landfill.
- Concentrations remain higher at the 600 Area Central Landfill than at the Non-Radioactive Dangerous Waste Landfill.

B.7.3 Conclusion

The 600 Area Central Landfill continues to be the source of the groundwater constituents that are responsible for the increased specific conductance at the Nonradioactive Dangerous Waste Landfill.

B.8 References

40 CFR 264, Appendix IX. "Ground-Water Monitoring List." U.S. Environmental Protection Agency, U.S. Code of Federal Regulations.

Atomic Energy Act. As amended, Ch. 1073, 68 Stat. 919, 42 USC 2011 et seq.

BHI-00873. 1996. *Description of Work for Routine Groundwater Sampling at the Environmental Restoration Disposal Facility*. BH Ford, Bechtel Hanford, Inc., Richland, Washington.

BNWL-1709. 1973. *Collection and Analysis of Pump Test Data for Transmissivity Values*. KL Kipp and RD Mudd, Battelle, Pacific Northwest Laboratory, Richland, Washington.

*Comprehensive Environmental Response, Compensation, and Liability Ac*t. 1980. Public Law 96-150, as amended, 94 Stat. 2767, 42 USC 9601 et seq.

DOE Order 435.1. 1999. "Radioactive Waste Management." U.S. Department of Energy, Washington, D.C.

DOE/RL-92-05, Rev. 0. 1993. *B Plant Source Aggregate Area Management Study Report.* U. S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-94-136. 1995. *Annual Report for RCRA Groundwater Monitoring Projects at Hanford Site Facilities for 1994.* U. S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-94-136, Rev. 0. 1995. *Annual Report for RCRA Groundwater Monitoring Projects at Hanford Site Facilities for 1994.* U. S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-96-61. 1997. *Hanford Site Background: Part 3, Groundwater Background.* U. S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2000-72, Rev. 1. 2006. *Performance Assessment Monitoring Plan for the Hanford Site Low-Level Burial Grounds*. U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2003-12, Rev. 0. 2003. *Hanford Facility Dangerous Waste Permit Application, Integrated Disposal Facility*. U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2006-20. 2006. *The Second CERCLA Five-Year Review Report for the Hanford Site.* U. S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2007-33, Draft A. 2007. *Proposed Plan for Remediation of the 200-ZP-1 Groundwater Operable Unit*. U. S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology. 1994. *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*. Permit Number WA7890008967, as amended. Washington State Department of Ecology, Olympia, Washington.

PNL-5408. 1985. *Groundwater Monitoring at the Hanford Site, January-December 1984*. CS Cline, JT Rieger, JR Raymond, and PA Eddy, Pacific Northwest Laboratory, Richland, Washington.

PNL-6716. 1988. *Interim Characterization Report for the 300 Area Process Trenches*. R Schalla, RW Wallace, RL Aaberg, SP Airhart, DJ Bates, JVM Carlile, CS Cline, DI Dennison, MD Freshley, PR Heller, EJ Jensen, KB Olsen, RG Parkhurst, JT Rieger, and EJ Westergard, Pacific Northwest Laboratory, Richland, Washington.

PNL-6728. 1988. *Geohydrologic Characterization of the Area Surrounding the 183-H Solar Evaporation Basins*. TL Liikala, RL Aaberg, NJ Aimo, DJ Bates, TJ Gilmore, EJ Jensen, GV Last, PL Oberlander, KB Olsen, KR Oster, LR Roome, JC Simpson, SS Teel, and EJ Westergard, Pacific Northwest Laboratory, Richland, Washington.

PNL-6820. 1989. *Hydrogeology for the 200 Areas Low-Level Burial Grounds - An Interim Report*. GV Last, BN Bjornstad, MP Bergeron, DW Wallace, DR Newcomer, JA Schramke, MA Chamness, CS Cline, SP Airhart, and JS Wilber, Pacific Northwest Laboratory, Richland, Washington.

PNL-6852. 1989. *RCRA Ground-Water Monitoring Projects for Hanford Facilities: Annual Progress Report for 1988*. RM Fruland and RE Lundgren (eds.), Pacific Northwest National Laboratory, Richland, Washington.

PNL-8335. 1992. *Applications of Three Aquifer Test Methods for Estimating Hydraulic Properties Within the 100-N Area*. TJ Gilmore, FA Spane, Jr., DR Newcomer, and CR Sherwood, Pacific Northwest Laboratory, Richland, Washington.

PNL-10195. 1994. *Three-Dimensional Conceptual Model for the Hanford Site Unconfined Aquifer System: FY 1994 Status Report*. PD Thorne, MA Chamness, VR Vermeul, QC MacDonald, and SE Schubert, Pacific Northwest Laboratory, Richland, Washington.

PNNL-11523. 1997. *Combination RCRA Groundwater Monitoring Plan for the 216-A-10, 216-A-36B, and 216-A-37-1 PUREX Cribs*. JW Lindberg, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-11523, Rev. 1. 2005. *Interim-Status RCRA Groundwater Monitoring Plan for the 216-A-10, 216-A-36B, and 216-A-37-1 PUREX Cribs*. JW Lindberg and RP Elmore, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-11523-ICN-1. 1998. *Combination RCRA Groundwater Monitoring Plan for the 216-A-10, 216-A-36B, and 216-A-37-1 PUREX Cribs, Interim Change Notice 1*. JW Lindberg, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-11573. 1997. *Groundwater Monitoring Plan for the 183-H Solar Evaporation Basins*. MJ Hartman, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-11957. 1998. *Immobilized Low-Activity Waste Site Borehole 299-E17-21*. SP Reidel, KD Reynolds, and DG Horton, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-12114-ICN-3. 2006. *RCRA Assessment Plan for Single-Shell Tank Waste Management Area S-SX at the Hanford Site, Interim Change Notice 3*. RM Smith, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-12227. 1999. *Groundwater Monitoring Plan for the Nonradioactive Dangerous Waste Landfill.* JW Lindberg and MJ Hartman, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-12227-ICN-1. 2001. *Groundwater Monitoring Plan for the Nonradioactive Dangerous Waste Landfill, Interim Change Notice 1*. JW Lindberg and MJ Hartman, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13014. 2000. *Groundwater Monitoring Plan for the Solid Waste Landfill*. JW Lindberg and CJ Chou, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13022-ICN-3. 2006. *Groundwater Quality Assessment Plan for Single-Shell Waste Management Area B-BX-BY at the Hanford Site, Interim Change Notice 3*. SM Narbutovskih, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13024-ICN-4. 2004. *RCRA Groundwater Monitoring Plan for Single-Shell Tank Waste Management Area C at the Hanford Site, Interim Change Notice 4*. SM Narbutovskih, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13032. 2000. *Groundwater Monitoring Plan for the Hanford Site 200 Area Treated Effluent Disposal Facility*. DB Barnett, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13047. 1999. *Groundwater Monitoring Plan for the 216-A-29 Ditch*. MD Sweeney, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13121. 2000. *Groundwater Monitoring and Tritium-Tracking Plan for the 200 Area State-Approved Land Disposal Site*. DB Barnett, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13378. 2001. *Results of Detailed Hydrologic Characterization Tests - Fiscal Year 1999.* FA Spane, Jr., PD Thorne, and DR Newcomer, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13514. 2001. *Results of Detailed Hydrologic Characterization Tests - Fiscal Year 2000.* FA Spane, PD Thorne, and DR Newcomer, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13612-ICN-2. 2006. *Groundwater Quality Assessment Plan for Single-Shell Tank Waste Management Area U, Interim Change Notice 2*. RM Smith, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13652. 2001. *Geologic and Wireline Borehole Summary from the Second ILAW Borehole (299-E24-21)*. SP Reidel, DG Horton, and MM Valenta, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13914. 2002. *Groundwater Monitoring Plan for the 1301-N, 1324-N/NA, and 1325-N RCRA Facilitie*s. MJ Hartman, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14033. 2002. *Groundwater Monitoring and Assessment Plan for the 100-K Area Fuel Storage Basins*. RE Peterson, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14070. 2002. *Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch.* BA Williams and CJ Chou, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14070-ICN-1. 2003. *Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch, Interim Change Notice 1*. BA Williams, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14070-ICN-2. 2006. *Groundwater Monitoring Plan for the 216-S-10 Pond and Ditch, Interim Change Notice 2*. BA Williams, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14112. 2002. *Groundwater Monitoring Plan for the 216-B-63 Trench on the Hanford Site.* MD Sweeney, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14113. 2002. *Results of Detailed Hydrologic Characterization Tests - Fiscal Year 2001*. FA Spane, Jr., PD Thorne, and DR Newcomer, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14186. 2003. *Results of Detailed Hydrologic Characterization Tests – Fiscal Year 2002*. FA Spane, DR Newcomer, and PD Thorne, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14301-Rev2-ICN-1. 2006. *Monitoring Plan for RCRA Groundwater Assessment at the 216-U-12 Crib*. BA Williams and CJ Chou, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-13404. 2001. *Hanford Site Groundwater Monitoring for Fiscal Year 2000*. MJ Hartman, LF Morasch, and WD Webber (eds.), Pacific Northwest national Laboratory, Richland, Washington.

PNNL-14753, Rev. 1. 2006. *Groundwater Data Package for Hanford Asses*sments. PD Thorne, MP Bergeron, MD Williams, and VL Freedman, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14804. 2004. *Results of Detailed Hydrologic Characterization Tests - Fiscal Year 2003*. FA Spane and DR Newcomer, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-14859-ICN-1. 2006. *Interim Status Groundwater Monitoring Plan for Low-Level Waste Management Areas 1 and 4, RCRA Facilities, Hanford, Washington*. P Dresel, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15301. 2006. *RCRA Assessment Plan for Single-Shell Tank Waste Management Area T*. DG Horton, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15315. 2006. *RCRA Assessment Plan for Single-Shell Tank Waste Management Area A-AX at the Hanford Site*. SM Narbutovskih, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15479. 2005. *Groundwater Monitoring Plan for the Hanford Site 216-B-3 Pond RCRA Facility*. DB Barnett, RM Smith, CJ Chou, and JP McDonald, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-15670. 2006. *Hanford Site Groundwater Monitoring for Fiscal Year 2005*. MJ Hartman, LF Morasch, and WD Webber (eds.), Pacific Northwest National Laboratory, Richland, Washington.

PNNL-16005. 2007. *RCRA Assessment Plan for Single-Shell Tank Waste Management Area TX-TY*. DG Horton, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-16198. 2006. *Carbon Tetrachloride Flow and Transport in the Subsurface of the 216-Z-18 Crib and 216-Z-1A Tile Field at the Hanford Site: Multifluid Flow Simulations and Conceptual Model Update*. M Oostrom, ML Rockhold, PD Thorne, GV Last, MJ Truex, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-16346. 2007. *Hanford Site Groundwater Monitoring for Fiscal Year 2006.* MJ Hartman, LF Morasch, and WD Webber (eds.), Pacific Northwest national Laboratory, Richland, Washington.

PNNL-16509. 2007. *Geostatistical Analyses of the Persistence and Inventory of Carbon Tetrachloride in the 200 West Area of the Hanford Site*. CJ Murray Y-J Bott, MJ Truex, Pacific Northwest National Laboratory, Richland, Washington.

Resource Conservation and Recovery Act. 1976. Public Law 94-580, as amended, 90 Stat. 2795, 42 USC 6901 et seq.

RHO-CD-673, Volume I. 1979. *200 Areas Waste Sites*. HL Maxfield, Rockwell Hanford Operations, Richland, Washington.

RPP-21895, Rev. 3. 2006. *241-C-103 and 241-C-109 Tanks Waste Retrieval Work Plan.* JS Schofield, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-PLAN-26534, Rev. C. 2005. *Integrated Disposal Facility Operational Monitoring Plan to Meet DOE Order 435.1*. Prepared by DR Lucas (DRL Technology Services), SP Reidel (Pacific Northwest National Laboratory), and RM Mitchell, (Duratek Federal Services) for the U.S. Department of Energy, Richland, Washington.

Shapiro SS. 1980. "How to Test Normality and Other Distributional Assumptions." In *ASQC Basic References in Quality Control: Statistical Techniques*, Vol. 3, EJ Dudewicz (ed.), American Society of Quality Control, Milwaukee, Wisconsin.

Shapiro SS and RS Francia. 1972. "Approximate Analysis of Variance Test for Normality." *Journal of the American Statistical Association* 67:215-216.

WAC 173-160. "Minimum Standards for Construction and Maintenance of Wells." *Washington Administrative Code*, Olympia, Washington.

WAC 173-304. “Minimum Functional Standards for Solid Waste Handling.” *Washington Administrative Code*, Olympia, Washington.

WAC 173-304-490. “Ground Water Monitoring Requirements.” *Washington Administrative Code*, Olympia, Washington.

WHC-EP-0021. 1987. *Interim Hydrogeologic Characterization Report and Groundwater Monitoring System for the Nonradioactive Dangerous Waste Landfill, Hanford Site, Washington.* DC Weekes, SP Luttrell, and MR Fuchs, Westinghouse Hanford Company, Richland, Washington.

WHC-EP-0595. *Westinghouse Hanford Company Operational Groundwater Status Report, 1990-1992.* Westinghouse Hanford Company, Richland, Washington.

WHC-MR-0207. 1990. *Borehole Completion Data Package for the 216-B-63 Trench--1990*. SM Goodwin, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-AP-024. 1990. *Interim Status Groundwater Monitoring Plan for the 200 East Area Liquid Effluent Retention Facility*. JS Schmid, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-AP-185. 1995. *Groundwater Monitoring Plan for the 300 Area Process Trenches*. JW Lindberg, CJ Chou, and VG Johnson, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-DP-047. 1992. *Borehole Completion Data Package for the 216-A-29 RCRA Facility Monitoring Wells: Calendar Year 1991*. GL Kasza, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-DP-052. 1993. *Borehole Completion Data Package for the 216-S-10 Facility, CY-1992*. BA Williams and DB Barnett, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-EV-002. 1990. *Interim Hydrogeologic Characterization Report for the 216-B-3 Pond*. Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-EV-003, Rev. 1. 2002. *Results of Ground Water Quality Assessment Monitoring at the 1301-N Liquid Waste Disposal Facility and 1324-N/NA Facilitie.* MJ Hartman, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-EV-025, Rev. 0. 1993. *Result of the Groundwater Quality Assessment Program at Low-Level Waste Management Area 1 of the Low-Level Burial Grounds.* Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-EV-031. Rev. 1. 1996. *RCRA Assessment Report: Total Organic Halogen at the 1324-N/NA Site.* MJ Hartman, Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-EV-032. 1995. *Results of Groundwater Quality Assessment Program at the 216-A-29 Ditch RCRA Facility.* JM Votava, Westinghouse Hanford Company, Richland, Washington.

Table B.1. Estimates of Groundwater Flow Rates at Hanford Site RCRA Facilities

Site	Flow Direction	Flow Rate (m/d)	Method	Hydraulic Conductivity (m/d) (source)	Effective Porosity[(a)]	Gradient[(b)]	Comments
116-N-1 LWDF	NW	0.03 to 0.58	Darcy	6.1 to 37 (PNL-8335)		0.0016	Gradient calculated between wells 199-N-34 and 199-N-2.
120-N-1 and 120-N-2	NW	0.05 to 0.95	Darcy	6.1 to 37 (PNL-8335)		0.0026	Gradient calculated between wells 199-N-72 and 199-N-26.
116-N-3 LWDF	N	0.02 to 0.37	Darcy	6.1 to 37 (PNL-8335)		0.0010	Gradient calculated between wells 199-N-28 and 199-N-81.
116-H-6 evaporation basins	E	0.21 to 5.9	Darcy	15 to 140 (PNL-6728)		0.0042	Gradient calculated between wells 199-H4-9 and 199-H4-12B.
216-A-29 ditch	SSW	Undetermined		18 (WHC-SD-EN-DP-047)	0.25		Gradient too low to determine flow rate.
216-B-3 pond	WSW to SSE	0.01	Darcy	1.0 (WHC-SD-EN-EV-002; PNL-10195)	0.25	0.002	Gradient calculated between wells 699-44-39B, 699-42-42B and 699-43-44.
216-B-63 trench	Undeter-mined	Undetermined		182 (WHC-MR-0207)			Uncertain of flow direction. Gradient too low to determine flow rate.
216-S-10 pond	ESE	0.075 to 2.25	Darcy	10 (WHC-SD-EN-DP-052) 12 to 150 (BNWL-1709)	0.1 to 0.2	0.0015	Wells are dry. Gradient calculated using regional water-table maps.
216-U-12 crib	ESE	0.027 to 0.05	Darcy	4.2 to 5.4 (PNNL-13378)	0.1 to 0.2	0.001	Gradient calculated from water-table map.
316-5 process trenches	SE	10.7 (PNL-5408)	Movement of PCE spill				
	SE	0.22 to 22	Darcy	150 to 15,000 (PNL-6716)	0.25	0.00036	Gradient calculated from December 2006 water-table map.
IDF	SE	0.002 to 0.0075	Darcy	68 to 75 (PNNL-13652; PNNL-11957)		0.00001	Uncertainty in gradient and rate of flow. Flow direction inferred from plume maps.
LERF	SW	0.24	Darcy	39.8 (PNNL-14804)	0.25	0.0016	Gradient calculated from water-table map.
LLWMA 1	Undeter-mined	Undetermined		2,500 to 7,500 (PNNL-14753)			Uncertain of flow direction. Gradient too low to determine flow rate.

Table B.1. (contd)

Site	Flow Direction	Flow Rate (m/d)	Method	Hydraulic Conductivity (m/d) (source)	Effective Porosity[a]	Gradient[b]	Comments
LLWMA 2	W to SW?	Undetermined		2,500 to 7,500 (PNNL-14753)			Uncertain of flow direction. Gradient too low to determine flow rate.
LLWMA 3	ENE	0.04 to 0.16	Darcy	2.5 to 10 (PNNL-14753)	0.1 (PNNL-14753)	0.0016	Flow direction and gradient from water-table map.
LLWMA 4	E	0.4 to 1.0	Darcy	10 to 25 (PNNL-14753)		0.004	Flow direction is variable due to effects of pump-and-treat system.
NRDWL	SE	0.03 to 0.27	Darcy	518 to 1,524 (WHC-EP-0021)		0.00002	Uncertainty with gradient and rate of flow. Flow direction inferred from plume maps.
PUREX cribs	SE	0.0011 to 0.54	Darcy	18 to 3,000 (PNNL-11523; PNNL-11523-ICN-1)		0.00002	Uncertainty with gradient and rate of flow. Flow direction inferred from plume maps.
WMA A-AX	SE	1.0 to 1.4	Darcy	1,981	0.3 to 0.4	0.0002	Gradient and flow rate calculated between wells 299-E24-20 and 299-E25-93.
WMA B-BX-BY	S	Nearly stagnant	Contaminant migration				
WMA C	SW to SSW	0.09	Contaminant migration				
WMA S-SX	E to ESE	0.07 to 0.14	Contaminant travel time (PNNL-13441)	NA	NA	NA	Based on inferred contaminant travel time between 216-S-25 crib and downgradient wells 299-W23-15 and 299-W22-46, and between wells 299-W22-46 and 299-W22-83.
		0.012 to 0.29	Darcy	1.33 to 14.4 (PNNL-13514 and PNNL-14113)	0.09 to 0.20	0.0018	Gradient determined by trend surface analysis.
WMA T	E	0.002 to 0.25	Darcy	1.04 to 28.1	0.1	0.0002 to 0.0009	Flow direction based on trend surface analysis: PNNL-14113, PNNL-13378.
WMA TX-TY	Variable (see text)	NA	NA	14.2 to 19.9 (PNNL-13378, PNNL-14113, and PNNL-14186	NA	NA	Flow direction and rate influenced by 200-ZP-1 pump-and-treat.
WMA U	E to ENE	0.018 to 0.20	Darcy	1.69 to 9.5 (PNNL-13378)	0.10 to 0.20	0.0021	Gradient determined by trend surface analysis.

(a) Effective porosity assumed to be between 0.1 and 0.3, a representative range for the unconfined aquifer system, unless otherwise noted.
(b) March 2007 unless noted otherwise.
IDF = Integrated Disposal Facility.
LERF = Liquid effluent retention facility.
LLWMA = Low-level waste management area.
LWDF = Liquid waste disposal facility.
NA = Not applicable.
NRDWL = Nonradioactive Dangerous Waste Landfill.
PCE = Tetrachloroethene.
PUREX = Plutonium-Uranium Extraction (Plant).
WMA = Waste management area.

Table B.2. Upgradient/Downgradient Comparison Values[a] Used for Statistical Comparisons at RCRA Sites in FY 2007

Quarter	Specific Conductance Critical Mean (μS/cm)	pH Critical Range	TOC Critical Mean[b]/LOQ (μg/L)	TOX Critical Mean/LOQ (μg/L)	Comments
116-N-1 (1301-N) Facility					
Jan-Mar 2007	**1,165**	**[6.24, 9.10]**	2,075/**2,320**	**38.3**/13.0	
Jul-Sep 2007	**1,165**	**[6.24, 9.10]**	**2,075**/1,450	**38.3**/22.5	
120-N-1 and 120-N-2 (1324-N/NA) Facilities					
Oct-Dec 2006	**490**	**[7.63, 8.50]**	2,010/**2,070**	**29.6**/22.6	2 downgradient wells
Apr-Jun 2007	**490**	**[7.63, 8.50]**	2,010/**2,070**	**29.6**/22.6	3 downgradient wells
116-N-3 (1325-N) Facility					
Jan-Mar 2007	**401**	**[7.59, 8.53]**	2,090/**2,320**	**27.0**/13.0	
Jul-Sep 2007	**401**	**[7.59, 8.53]**	**2,090**/1,450	**27.0**/22.5	
216-A-29 Ditch					
Oct-Dec 2006	**274**	**[6.99, 9.86]**	**2,360**/2,070	20.0/**22.6**	
Apr-Jun 2007	**274**	**[6.99, 9.86]**	**2,360**/2,070	20.0/**22.6**	
216-B-3 Pond					
Jan-Mar 2007	**338**	**[7.74, 8.55]**	1,190/**2,320**	**27.6**/13.0	
Jul-Sep 2007	**338**	**[7.74, 8.55]**	1,190/**1,450**	**27.6**/22.5	
216-B-63 Ditch					
Oct-Dec 2006	**739**	**[7.51, 8.58]**	1,120/**2,070**	20.4/**22.6**	
Apr-Jun 2007	**739**	**[7.51, 8.58]**	1,120/**2,070**	20.4/**22.6**	
216-S-10 Pond and Ditch					
Oct-Dec 2006	**296**	**[7.49, 8.73]**	1,300/**2,070**	NC/**22.6**	
Apr-Jun 2007	**296**	**[7.49, 8.73]**	1,300/**2,070**	NC/**22.6**	
Low Level Waste Management Area 1					
Oct-Dec 2006	**808**	**[7.44, 8.57]**	**2,770**/2,070	18.5/**22.6**	
Apr-Jun 2007	**808**	**[7.44, 8.57]**	**2,770**/2,070	18.5/**22.6**	
Low Level Waste Management Area 2					
Oct-Dec 2006	**1,397**	**[6.95, 8.48]**	**2,460**/2,070	**62.1**/22.6	
Apr-Jun 2007	**1,397**	**[6.95, 8.48]**	**2,460**/2,070	**62.1**/22.6	
Low Level Waste Management Area 3					
No statistical comparisons until new baseline established					
Low Level Waste Management Area 4					
Jan-Mar 2007	**626**	**[7.34, 8.57]**	1,320/**2,320**	**44.1**/13.0	
Jul-Sep 2007	**626**	**[7.34, 8.57]**	1,320/**1,450**	**44.1**/22.5	
Nonradioactive Dangerous Waste Landfill					
Jan-Mar 2007	**594**	**[6.55, 7.89]**	1,510/**2,320**	**24.3**/13.0	
Jul-Sep 2007	**594**	**[6.55, 7.89]**	**1,510**/1,450	**24.3**/22.5	
Waste Management Area C					
Oct-Dec 2006	**941**	**[7.34, 8.91]**	**2,480**/2,070	**41.2**/22.6	
Apr-Jun 2007	**941**	**[7.34, 8.91]**	**2,480**/2,070	**41.2**/22.6	

(a) Upgradient/Downgradient comparison values **(in bold)** for TOC and TOX are the larger of calculated critical mean value and limit of quantitation for the respective quarter. Starting in April-June 2007, the statistician began to use the LOQ calculated the previous quarter instead of the new one.
(b) Reported values rounded to the nearest 10 ug/L.
LOQ = Limit of quantitation; based on field blanks collected and analyzed in the previous four quarters.
TOC = Total organic carbon.
TOX = Total organic halides.

Table B.3. Monitoring Wells and Constituents for 100-N Area Units (adapted from PNNL-13914)

			Contamination Indicator Parameters				Other Parameters				
Well Number[a]	Comment	WAC Compliant	Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Alpha[b]	Anions	Metals (filtered)	Sampled as Scheduled in FY 2007
116-N-1 (1301-N) Liquid Waste Disposal Facility											
199-N-105A		C	S	S	S	S	A		A	A	Yes
199-N-2		P	S	S	S	S	A		A	A	Yes
199-N-3		P	S	S	S	S	A		A	A	Yes
199-N-34		P	S	S	S	S	A		A	A	Yes
199-N-57		C	S	S	S	S	A		A	A	Yes
120-N-1 and 120-N-2 (1324-N/NA) Facilities											
199-N-59		C	S	S	S	S	A	A	A	A	Sampled once; insufficient water
199-N-71		C	S	S	S	S	A		A	A	Yes
199-N-72		C	S	S	S	S	A		A	A	Yes
199-N-73		C	S	S	S	S	A		A	A	Yes
199-N-77	Bottom of aquifer; no statistics	C	S	S	S	S	A	S	A	A	Yes
116-N-3 (1325-N) Liquid Waste Disposal Facility											
199-N-28	Information only; no statistics	P	S	S	S	S	A		A	A	Yes
199-N-32		P	S	S	S	S	S		S	S	Missed field quadruplicates once
199-N-41		P	S	S	S	S	A		A	A	Yes
199-N-74		C	S	S	S	S	A		A	A	Yes
199-N-81		C	S	S	S	S	A		A	A	Yes

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) ***Bold italic*** = Upgradient well.
(b) Monitored for *Atomic Energy Act* .
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
P = Constructed prior to WAC requirements.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
WAC = *Washington Administrative Code* .

Table B.4. Critical Means for 116-N-1 Liquid Waste Disposal Facility for FY 2008 Comparisons[a]

Constituent, unit	n	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, µS/cm	9	8	5.0413	596.2	138	1,330	1,330
Field pH	9	8	5.6174	7.68	0.261	[6.14, 9.23]	[6.14, 9.23]
Total organic carbon,[b] µg/L	9	8	5.0413	476.1	252.1	1,816	1,816
Total organic halides,[b] µg/L	8[c]	7	5.4079	8.49	4.03	31.6	31.6

(a) Based on semiannual sampling events from March 2006 to September 2007 for upgradient well 199-N-57 and from September 2005 to September 2007 for upgradient well 199-N-34.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
(c) Excluded suspected values on samples collected in September 2005 from upgradient well 199-N-34.
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
t_c = Bonferroni critical t-value for appropriate df and 20 comparisons.

Table B.5. Critical Means for 120-N-1 and 120-N-2 Liquid Waste Disposal Facilities for FY 2008 Comparisons[a]

Constituent, unit	n	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, µS/cm	5	4	7.5287	385.25	23.82	582	582
Field pH	5	4	9.0294	8.093	0.04	[7.70, 8.49]	[7.70, 8.49]
Total organic carbon,[b] µg/L	5[c]	4	7.5287	427.75	164.78	1,787	1,787
Total organic halides,[b] µg/L	5	4	7.5287	7.03	2.34	26.3	26.3

(a) Based on semiannual sampling events from June 2005 to June 2007 for upgradient well 199-N-71; except March 2005 to June 2007 for total organic carbon.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
(c) Excluded "R" flagged values on samples collected December 2006.
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
t_c = Bonferroni critical t-value for appropriate df and 12 comparisons

Table B.6. Critical Means for 116-N-3 Liquid Waste Disposal Facility for FY 2008 Comparisons[(a)]

Constituent, unit	n	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, µS/cm	5	4	8.1216	376.6	7.72	445	445
Field pH	5	4	9.7291	8.04	0.06	[7.40, 8.67]	[7.40, 8.67]
Total organic carbon,[(b)] µg/L	5	4	8.1216	318	173.08	1,858	1,858
Total organic halides,[(b)] µg/L	5	4	8.1216	6.081	2.50	28.3	28.3

(a) Based on semiannual sampling events from September 2005 to September 2007 for upgradient well 199-N-74.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
t_c = Bonferroni critical t-value for appropriate df and 16 comparisons.

Table B.7. Monitoring Wells and Constituents for 116-H-6 Evaporation Basins (adapted from PNNL-11573 and 2006 permit modification[(a)])

Well Number	Comment	WAC Compliant	Permit-Specified				Other Parameters			Sampled as Scheduled in FY 2007
			Hex Cr (filtered)	Nitrate	Technetium-99[(b)]	Uranium[(b)]	Alkalinity	Anions	Metals (filtered)	
199-H4-12A	Extraction well	C	A	A	A	A	A	A	A	Yes
199-H4-12C	Mid-depth unconfined	C	A	A	A	A	A	A	A	Yes
199-H4-3	Extraction well	P	A	A	A	A	A	A	A	Yes
199-H4-8		C	A	A	A	A	A	A	A	Yes

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) Hanford Facility RCRA Permit Modification Notification Form, signed by GP Davis (Ecology), January 10, 2006. 183-H Solar Evaporation Basins, Part VI, Chapter 2, and Attachment 37.
(b) Radionuclides not typically subject to RCRA monitoring, but included in the current Hanford Facility RCRA Permit (Ecology 1994) for this facility.
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
Hex Cr = Hexavalent chromium.
P = Constructed prior to WAC requirements.
RCRA = *Resource Conservation and Recovery Act* .
WAC = *Washington Administrative Code* .

Table B.8. Monitoring Wells and Constituents for 216-A-29 Ditch (adapted from PNNL-13047)

			Contamination Indicator Parameters				Other Parameters				
Well Number[(a)]	Comment	WAC Compliant	Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals (filtered)	Phenols	Sampled as Scheduled in FY 2007
299-E25-26	Upper unconfined	C	S	S	S	S	S	S	A	A	Yes
299-E25-28	Deep unconfined; no statistics	C	S	S	S	S	S	S	A	A	TOC and TOX only once[(b)]
299-E25-32P		C	S	S	S	S	S	S	A	A	Yes
299-E25-34		C	S	S	S	S	S	S	A	A	Yes
299-E25-35		C	S	S	S	S	S	S	A	A	Yes
299-E25-48		C	S	S	S	S	S	S	A	A	Yes
299-E26-12		C	S	S	S	S	S	S	A	A	Yes
299-E26-13		C	S	S	S	S	S	S	A	A	Yes
699-43-45		C	S	S	S	S	S	S	A	A	Yes

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) ***Bold italic*** = Upgradient well.
(b) Not needed for this supplement well.
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
TOC = Total organic carbon.
TOX = Total organic halides.
WAC = *Washington Administrative Code* .

Table B.9. Critical Means for 216-A-29 Ditch for FY 2008 Comparisons[(a)]

Constituent, unit	n	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, μS/cm	6	5	7.6037	243.2	3.19	269	269
Field pH	7	6	7.4012	8.39	0.15	[7.24, 9.55]	[7.24, 9.55]
Total organic carbon,[(b)] μg/L	5[(c)]	4	9.7291	301.8	73.63	1,086	1,430[(d)]
Total organic halides,[(b)] μg/L	6	5	7.6037	4.65	2.61	26.1	26.1

(a) Based on semiannual sampling events from October 2005 to July 2007 (July 2005 to July 2007 for pH) for upgradient well 699-43-45.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
(c) Excluded suspected values on samples collected in April 2006.
(d) Upgradient/downgradient comparison value is the most recently determined limit of quantitation (updated quarterly).
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
t_c = Bonferroni critical t-value for appropriate df and 32 comparisons.

Table B.10. Monitoring Wells and Constituents for 216-B-3 Pond (adapted from PNNL-15479)

			Contamination Indicator Parameters				Other Parameters						
Well Number[(a)]	Comment	WAC Compliant	Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Alpha[(b)]	Anions	Beta[(b)]	Metals (filtered, unfiltered)	Phenols	Sampled as Scheduled in FY 2007
699-42-42B	Bottom of aquifer	C	S	S	S	S	A	S	A	S	A	A	Yes
699-43-44		C	S	S	S	S	A	S	A	S	A	A	Yes
699-43-45		C	S	S	S	S	A	S	A	S	A	A	Yes
699-44-39B		C	S	S	S	S	A	S	A	S	A	A	Yes

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) ***Bold italic*** = Upgradient well.
(b) Monitored for *Atomic Energy Act* .
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
WAC = *Washington Administrative Code* .

Table B.11. Critical Means for 216-B-3 Pond for FY 2008 Comparisons[(a)]

Constituent, unit	n	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, μS/cm	6	5	6.5414	255.0	10.26	328	328
Field pH	6	5	7.6037	8.19	0.14	[7.07, 9.30]	[7.07, 9.30]
Total organic carbon,[(b)] μg/L	5[(d)]	4	8.1216	297.8	96.65	1,158	1,430[(c)]
Total organic halides,[(b)] μg/L	5[(d)]	4	8.1216	3.27	2.59	26.3	26.3

(a) Based on semiannual sampling events from January 2005 to July 2007 from upgradient well 699-44-39B.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
(c) Upgradient/downgradient comparison value is the most recently determined limit of quantitation (updated quarterly).
(d) Excluded rejected total organic carbon values on samples collected February 2007 and anomalously high total organic halides values flagged "F" collected February 2007.
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
t_c = Bonferroni critical t-value for appropriate df and 16 comparisons.

Table B.12. Monitoring Wells and Constituents for 216-B-63 Trench (adapted from PNNL-14112)

Well Number[a]	WAC Compliant	Contamination Indicator Parameters: Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Other Parameters: Alkalinity	Alpha[b]	Anions	Beta[b]	Metals (filtered)	Phenols	Sampled as Scheduled in FY 2007
299-E27-8	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E27-9	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E27-11	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E27-16	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E27-17	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E27-18	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E27-19	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E33-33	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E33-36	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E33-37	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E34-8	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E34-10	C	S	S	S	S	A	S	A	S	A	A	Yes

Wells completed at the top of the unconfined aquifer.
(a) ***Bold italic*** = Upgradient well.
(b) Monitored for *Atomic Energy Act*.
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
WAC = *Washington Administrative Code*.

Table B.13. Critical Means for 216-B-63 Trench for FY 2008 Comparisons[a]

Constituent, unit	n	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, μS/cm	20	19	4.2669	461.6	74.77	789	789
Field pH	20	19	4.5718	8.10	0.13	[7.48, 8.73]	[7.48, 8.73]
Total organic carbon,[b] μg/L	20	19	4.2669	368.0	155.12	1,046	1,430[c]
Total organic halides,[b] μg/L	20	19	4.2669	4.72	3.99	22.2	22.9[c]

(a) Based on semiannual sampling events from October 2005 to April 2007 for upgradient wells 299-E27-8, 299-E27-9, 299-E27-11, and 299-E27-17 and 299-E34-10.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
(c) Upgradient/downgradient comparison value is the most recently determined limit of quantitation (updated quarterly).
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
t_c = Bonferroni critical t-value for appropriate df and 48 comparisons.

Table B.14. Monitoring Wells and Constituents for 216-S-10 Pond and Ditch (adapted from PNNL-14070 and PNNL-14070-ICN-2)

Well Number	Comment	WAC Compliant	Contamination Indicator Parameters: Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Other Parameters: Alkalinity	Anions	Carbon Tetrachloride	Chloroform	Hex Cr (filtered)	Metals (filtered)	Phenols	Vanadium (filtered)	Sampled as Scheduled in FY 2007
299-W26-13		C	S	S	S	S	S	A	A	A	S	A	A	A	Yes
299-W26-14		C	S	S	S	S	S	A	A	A	S	A	A	A	Yes
299-W27-2	Bottom of aquifer; no statistics	C	S	S	S	S	S	A	A	A	S	A	A	A	Yes

Wells completed at the top of the unconfined aquifer unless specified otherwise.
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
Hex Cr = Hexavalent chromium.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
WAC = *Washington Administrative Code* .

Table B.15. Critical Means for 216-S-10 Pond and Ditch for FY 2008 Comparisons[(a)]

Constituent, unit	N	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, µS/cm	4	3	10.8689	269.8	2.2	296	296
Field pH	4	3	13.745	8.11	0.04	[7.49, 8.73]	[7.49, 8.73]
Total organic carbon,[(b)] µg/L	4	3	10.8689	195.6	90.9	1,300	1,430[(c)]
Total organic halides,[(d)] µg/L	4	3	10.8689	NC	NC	NC	22.9[(c)]

(a) Based on semiannual sampling events from December 2001 to June 2003 for upgradient well 299-W26-7, which went dry in 2003. Background levels will be revised when data from a new upgradient well are available.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
(c) Upgradient/downgradient comparison value is the most recently determined limit of quantitation (updated quarterly).
(d) Critical mean cannot be calculated because essentially all measurements are below vendor specified detection limit.
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
NC = Not calculated.
t_c = Bonferroni critical t-value for appropriate df and 12 comparisons.

Table B.16. Monitoring Wells and Constituents for 216-U-12 Crib (adapted from PNNL-14301-Rev2-ICN-1)

Well Number[(a)]	WAC Compliant	Alkalinity	Anions	Arsenic (filtered)	Metals (filtered)	Total Dissolved Solids	Technetium-99[(b)]	Sampled as Scheduled in FY 2007
299-W21-2	C	A	Q	A	A	A	Q	Yes
299-W22-79	C	A	Q	A	A	A	Q	Yes
299-W22-87	C	A	Q	A	A	A	Q	Yes
699-36-70A	C	A	Q	A	A	A	Q	Yes

Wells completed at the top of the unconfined aquifer.
(a) ***Bold italic*** = Upgradient well.
(b) Monitored for *Atomic Energy Act* .
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
Q = To be sampled quarterly.
WAC = *Washington Administrative Code* .

Table B.17. Monitoring Wells and Constituents for 316-5 Process Trenches (adapted from WHC-SD-EN-AP-185)

Well Number	Comment	WAC Compliant	cis-1,2-dichloroethene	Tetrachloroethene	Trichloroethene	Uranium[(a)]	Sampled as Scheduled in FY 2007
399-1-10A		C	S	S	S	S	Yes
399-1-10B	Lower unconfined	C	S	S	S	S	Yes
399-1-16A		C	S	S	S	S	Yes
399-1-16B	Lower unconfined	C	S	S	S	S	Yes
399-1-17A		C	S	S	S	S	Yes
399-1-17B	Lower unconfined	C	S	S	S	S	Yes
399-1-18A		C	S	S	S	S	Yes
399-1-18B	Lower unconfined	C	S	S	S	S	Yes

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) Radionuclides not typically subject to RCRA monitoring, but included in the current Hanford Facility RCRA Permit (Ecology 1994) for this facility.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
RCRA = *Resource Conservation and Recovery Act* .
S = Sampled four consecutive months, twice per year (semiannually).
WAC = *Washington Administrative Code* .

Table B.18. Monitoring Wells and Constituents for Integrated Disposal Facility (adapted from DOE/RL-2003-12 and RPP-PLAN-26534)

		Indicator Parameters					Other Parameters							
Well Number[(a)]	WAC Compliant	Chromium (filtered, unfiltered)	Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals (filtered)	Alpha[(b)]	Beta[(b)]	Iodine-129[(b)]	Technetium-99[(b)]	Sampled as Scheduled in FY 2007
299-E17-22	C	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S	S	S	S	S	S	S	Yes
299-E17-23	C	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S	S	S	S	S	S	S	Tc-99 only once
299-E17-25	C	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S	S	S	S	S	S	S	No Tc-99; I-129, alpha & beta only once
299-E17-26	C	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S	S	S	S	S	S	S	No Tc-99, I-129, alpha or beta
299-E18-1	C	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S	S	S	S	S	S	S	No Tc-99; I-129, alpha & beta only once
299-E24-21	C	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S	S	S	S	S	S	S	No Tc-99, I-129, alpha or beta
299-E24-24	C	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S[(c)]	S	S	S	S	S	S	S	No Tc-99, I-129, alpha or beta

Wells completed at the top of the unconfined aquifer.
(a) ***Bold italic*** = Designated as upgradient well in DOE/RL-2003-12.
(b) Operational parameters monitored for DOE Order 435.1.
(c) Sampled four times semiannually (total of eight times per well per year).
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
WAC = *Washington Administrative Code* .

Table B.19. Monitoring Wells and Constituents for Liquid Effluent Retention Facility (adapted from WHC-SD-EN-AP-024)

Well Number[(a)]	WAC Compliant	Alkalinity	Alpha[(b)]	Ammonia	Anions	Beta[(b)]	Metals (filtered)	Phenols	Volatile Organic Analyses	Sampled as Scheduled in FY 2007
299-E26-10	C	A	S	S	A	S	A	A	S	Ammonia only once
299-E26-11	C	A	S	S	A	S	A	A	S	Ammonia only once

Wells completed at the top of the unconfined aquifer.
Statistical evaluations suspended in 2001 because only one downgradient well is not dry.
(a) ***Bold italic*** = Upgradient well.
(b) Monitored for *Atomic Energy Act* .
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
S = To be sampled semiannually.
WAC = *Washington Administrative Code* .

Table B.20. Monitoring Wells and Constituents for Low-Level Waste Management Area 1 (adapted from PNNL-14859-ICN-1 and DOE/RL-2000-72)

		Contamination Indicator Parameters				Other Chemical Parameters						AEA Parameters[b]				
Well Number[a]	WAC Compliant	pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals (filtered)	Mercury (filtered)	Lead (filtered)	Phenols	Iodine-129	Technetium-99	Tritium	Uranium	Sampled as Scheduled in FY 2007
299-E28-26	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E28-27	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E28-28	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-2	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-3	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-4	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-5	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-6	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-7	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-8	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-9	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-10	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E33-28	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E33-29	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E33-30	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E33-34	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E33-35	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) ***Bold italic*** = Upgradient well.
(b) Monitored for DOE Order 435.1.
A = To be sampled annually.
AEA = *Atomic Energy Act*.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
WAC = *Washington Administrative Code*.

Table B.21. Critical Means for Low-Level Waste Management Area 1 for FY 2008 Comparisons[a]

Constituent, unit	n	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, µS/cm	28	27	4.1540	511.4	74.99	828	828
Field pH	28	27	4.4137	7.98	0.07	[7.68, 8.29]	[7.68, 8.29]
Total organic carbon,[b] µg/L	29[c]	28	4.1327	586.5	527.95	2,806	2,806
Total organic halides,[b] µg/L	28[c]	27	4.1540	4.82	5.11	26.4	26.4

(a) Based on semiannual sampling events from December 2005 to June 2007 for upgradient wells 299-E28-26, 299-E28-27, 299-E28-28, 299-E32-4, and 299-E33-29; and January 2006 to June 2007 for upgradient wells 299-E33-28 and 299-E33-35.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
(c) Excluded "R" flagged total organic carbon data collected January 2007 for 299-E33-28, anomalously high total organic halides value in December 2006 for 299-E28-26, not confirmed by subsequent sampling.
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
t_c = Bonferroni critical t-value for appropriate df and 68 comparisons.

Table B.22. Monitoring Wells and Constituents for Low-Level Waste Management Area 2 (adapted from PNNL-14859-ICN-1 and DOE/RL-2000-72)

		Contamination Indicator Parameters				Other Chemical Parameters							AEA Parameters[b]				
Well Number[a]	WAC Compliant	pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals (filtered)	Mercury (filtered)	Lead (filtered)	Polychlorinated Biphenyls	Phenols	Iodine-129	Technetium-99	Tritium	Uranium	Sampled as Scheduled in FY 2007
299-E27-8	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E27-9	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E27-10	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E27-11	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E27-17	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E34-2	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E34-9	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E34-10	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-E34-12	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes

Wells completed at the top of the unconfined aquifer.
(a) ***Bold italic*** = Upgradient well.
(b) Monitored for DOE Order 435.1.
A = To be sampled annually.
AEA = *Atomic Energy Act*.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
WAC = *Washington Administrative Code*.

Table B.23. Critical Means for Low-Level Waste Management Area 2 for FY 2008 Comparisons[a]

Constituent, unit	n	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, μS/cm	5	4	10.0298	1,004.5	33.46	1,372	1,372
Field pH	5	4	11.9851	7.70	0.04	[7.16, 8.24]	[7.16, 8.24]
Total organic carbon,[b] μg/L	5	4	10.0298	853.3	277.32	3,900	3,900
Total organic halides,[b] μg/L	6	5	7.7981	10.88	6.50	65.7	65.7

(a) Based on semiannual sampling events from April 2005 to April 2007 for upgradient well 299-E27-10.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
t_c = Bonferroni critical t-value for appropriate df and 36 comparisons.

Table B.24. Monitoring Wells and Constituents for Low-Level Waste Management Area 3 (adapted from PNNL-14859-ICN-1 and DOE/RL-2000-72)

Well Number	Comment	WAC Compliant	Contamination Indicator Parameters				Other Chemical Parameters							AEA Parameters[(a)]				Sampled as Scheduled in FY 2007
			pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals (filtered)	Mercury (filtered)	Lead (filtered)	Phenols	Volatile Organic Analyses	Iodine-129	Technetium-99	Tritium	Uranium	
299-W7-3	Deep unconfined; no statistics	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W7-4		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W8-1	Pump lowered 0.762 m 9/2007	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W10-14	Deep unconfined	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W10-29		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	No quadruplicates once
299-W10-30		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W10-31		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	No quadruplicates once

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) Monitored for DOE Order 435.1.
A = To be sampled annually.
AEA = *Atomic Energy Act* .
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
WAC = *Washington Administrative Code* .

Table B.25. Monitoring Wells and Constituents for Low-Level Waste Management Area 4 (adapted from PNNL-14859-ICN-1 and DOE/RL-2000-72)

			Contamination Indicator Parameters				Other Chemical Parameters							AEA Parameters(b)				
Well Number(a)	Comment	WAC Compliant	pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals (filtered)	Mercury (filtered)	Lead (filtered)	Phenols	Volatile Organic Analyses	Iodine-129	Technetium-99	Tritium	Uranium	Sampled as Scheduled in FY 2007
299-W15-15		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W15-17	Deep unconfined; no statistics	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	I-129 only once
299-W15-30		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W15-83		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	No quadruplicates once
299-W15-94		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	I-129, Tc-99 & tritium only once
299-W15-152		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	No field quadruplicates once
299-W15-224		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	I-129 only once; missed one quadruplicate TOX
299-W18-21		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W18-22	Deep unconfined; no statistics	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W18-23		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	I-129 only once; no field quadruplicates once

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) ***Bold italic*** = Upgradient well.
(b) Monitored for DOE Order 435.1.
A = To be sampled annually.
AEA = *Atomic Energy Act* .
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
TOX = Total organic halides.
WAC = *Washington Administrative Code* .

Table B.26. Critical Means for Low-Level Waste Management Area 4 for FY 2008 Comparisons(a)

Constituent, unit	n	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, µS/cm	11	10	4.8980	515.3	36.19	700	700
Field pH	11	10	5.3746	8.00	0.14	[7.21, 8.78]	[7.21, 8.78]
Total organic carbon,(b) µg/L	12	11	4.7244	335.3	94.89	802	1,430(c)
Total organic halides,(b) µg/L	12	11	4.7244	3.51	2.02	13.4	22.9(c)

(a) Based on semiannual sampling events from upgradient wells. For wells 299-W15-15 and 299-W18-21: data from January 2005 to July 2007. For well 299-W18-23 specific conductance and pH, data from February 2005 to February 2007. For well 299-W18-23 total organic carbon and total organic halides, data from February 2005 to July 2007.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
(c) Upgradient/downgradient comparison value is the most recently determined limit of quantitation (updated quarterly).
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
t_c = Bonferroni critical t-value for appropriate df and 32 comparisons.

Table B.27. Monitoring Wells and Constituents for the Nonradioactive Dangerous Waste Landfill (adapted from PNNL-12227 and PNNL-12227-ICN-1)

Well Number[a]	Comment	WAC Compliant	Contamination Indicator Parameters: pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Other Parameters: Anions	Metals (filtered)	Phenols	Volatile Organic Analyses	Sampled as Scheduled in FY 2007
699-25-33A	Top of LPU; no statistics	C	S	S	S	S	S	A	A	S	Yes
699-25-34A		C	S	S	S	S	S	A	A	S	Yes
699-25-34B		C	S	S	S	S	S	A	A	S	Yes
699-25-34D		C	S	S	S	S	S	A	A	S	Yes
699-26-33		C	S	S	S	S	S	A	A	S	Yes
699-26-34A		C	S	S	S	S	S	A	A	S	Yes
699-26-34B		C	S	S	S	S	S	A	A	S	Yes
699-26-35A		C	S	S	S	S	S	A	A	S	Yes
699-26-35C	Top of LPU; no statistics	C	S	S	S	S	S	A	A	S	Yes

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) ***Bold italic*** = Upgradient well.
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
LPU = Low-permeability in upper Ringold Formation.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
WAC = *Washington Administrative Code*.

Table B.28. Critical Means for Nonradioactive Dangerous Waste Landfill for FY 2008 Comparisons[a]

Constituent, unit	n	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, µS/cm	8	7	5.7282	546.8	12.05	620	620
Field pH	8	7	6.4295	7.24	0.08	[6.68, 7.81]	[6.68, 7.81]
Total organic carbon,[b] µg/L	6[c]	5	7.3884	374.0	80.79	1,019	1,430[d]
Total organic halides,[b] µg/L	9	8	5.3162	5.53	3.79	26.8	26.8

(a) Based on most recent sampling events from August 2005 to August 2007 for upgradient well 699-26-34A and from August 2005 to September 2007 for well 699-26-35A.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
(c) Excluded suspected total organic carbon values collected in August 2005 from well 699-26-34A and in February 2006 from wells 699-26-34A and 699-26-35A.
(d) Upgradient/downgradient comparison value is the most recently determined limit of quantitation (updated quarterly).
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
t_c = Bonferroni critical t-value for appropriate df and 28 comparisons.

Table B.29. Monitoring Wells and Constituents for RCRA PUREX Cribs 216-A-10, 216-A-36B, and 216-A-37-1 (adapted from PNNL-11523, Rev. 1)

			Primary RCRA Constit.	Supporting Parameters			
Well Number	Comment	WAC Compliant	Nitrate	Anions	Metals (filtered)	Phenols	Sampled as Scheduled in FY 2007
299-E17-1	216-A-10	P	S	S	S	A	Yes
299-E17-14	216-A-36B	C	Q	Q	Q	A	Yes
299-E17-16	216-A-36B	C	S	S	S	A	Yes
299-E17-18	216-A-36B	C	S	S	S	A	Yes
299-E17-19	216-A-10	C	S	S	S	A	Yes
299-E24-16	216-A-10	C	Q	Q	Q	A	Yes
299-E24-18	Upgradient	C	S	S	S	A	Yes
299-E25-17	216-A-37-1	P	S	S	S	A	Yes
299-E25-19	216-A-37-1	P	Q	Q	Q	A	Fourth delay until 10/2007
299-E25-31	Upgradient	C	S	S	S	A	Yes
699-37-47A	216-A-37-1	C	S	S	S	A	Yes
124 Wells	Far-field		(a)	(a)			See Appendix A for 200-PO-1

Wells completed at the top of the unconfined aquifer.
(a) Far-field wells sampled annually to triennially in conjunction with 200-PO-1 Operable Unit.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
P = Constructed prior to WAC requirements.
Q = To be sampled quarterly.
RCRA = *Resource Conservation and Recovery Act* .
S = To be sampled simiannually.
WAC = *Washington Administrative Code* .

Table B.30. Monitoring Wells and Constituents for Waste Management Area A-AX (adapted from PNNL-15315)

Well Number[a]	WAC Compliant	Site-Specific Constituents										Sampled as Scheduled in FY 2007
		Nitrate	Sodium (filtered)	Sulfate	Total Organic Carbon	Chromium (filtered)	Lead (filtered)	Alkalinity	Anions	Metals (filtered)	Technetium-99[b]	
299-E24-20	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E24-22	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E24-33	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-2	P	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-40	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-41	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-93	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-94	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes

Wells completed at the top of the unconfined aquifer.
(a) ***Bold italic*** = Upgradient well.
(b) *Atomic Energy Act* parameter.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
P = Constructed prior to WAC requirements.
Q = To be sampled quarterly.
WAC = *Washington Administrative Code* .

Table B.31. Monitoring Wells and Constituents for Waste Management Area B-BX-BY (adapted from PNNL-13022-ICN-3)

		RCRA Parameters				AEA Parameters				
Well Number[(a)]	WAC Compliant	Alkalinity	Anions	Cyanide	Metals (filtered)	Gamma	Technetium-99	Tritium	Uranium	Sampled as Scheduled in FY 2007
299-E33-9	P	Q	Q	Q	Q	S	Q	Q	Q	Cyanide and uranium twice; gamma once
299-E33-7	P	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-9	P	Q	Q	Q	Q	S	Q	Q	Q	Sampled 3 times
299-E33-15	P	S	S	S	S	S	S	S	S	Yes
299-E33-16	P	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-17	P	A	A	A	A		A	A	A	Yes
299-E33-18[(b)]	P	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-20	P	A	A	A	A		A	A	A	Yes
299-E33-21	P	A	A	A	A		A	A	A	Yes
299-E33-26	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-31	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-32	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-38	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-39	C	Q	Q	Q	Q	S	Q	Q	Q	No gamma
299-E33-41	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-42	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-43	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-44	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-47	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-48	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-49	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-334	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-335	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-337	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-338	C	Q	Q	Q	Q		Q	Q	Q	Yes
299-E33-339	C	Q	Q	Q	Q		Q	Q	Q	Yes

Wells completed at the top of the unconfined aquifer.
(a) Bold italic = Upgradient well.
(b) Upgradient of 241-B Tank Farm but downgradient of 241-BY Tank Farm.
A = To be sampled annually.
AEA = *Atomic Energy Act* .
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
P = Constructed prior to WAC requirements.
Q = To be sampled quarterly.
RCRA = *Resource Conservation and Recovery Act* .
S = To be sampled semiannually.
WAC = *Washington Administrative Code* .

Table B.32. Monitoring Wells and Constituents for Waste Management Area C (adapted from PNNL-13024-ICN-4 and RPP-21895)

Well Number[a]	WAC Compliant	Contamination Indicator Parameters: pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Other Chemical Parameters: Alkalinity	Anions	Cyanide	Metals (filtered)	Phenols	AEA Parameters: Beta	Gamma	Technetium-99	Uranium	Sampled as Scheduled in FY 2007
299-E27-4	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Q	Yes
299-E27-7	P	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Q	Yes
299-E27-12	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Q	Yes
299-E27-13	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Q	Yes
299-E27-14[b]	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Q	Yes
299-E27-15	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Q	Yes
299-E27-21	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Q	Yes
299-E27-22	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Q	Yes
299-E27-23	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Q	Yes

Wells completed at the top of the unconfined aquifer.
(a) ***Bold italic*** = Upgradient well.
(b) Well is cross-gradient to the C Tank Farm but downgradient of a waste transfer line.
A = To be sampled annually.
AEA = *Atomic Energy Act* .
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
P = Constructed prior to WAC requirements.
Q = To be sampled quarterly.
S = To be sampled semiannually.
Spec. Cond. = Specific conductance.
WAC = *Washington Administrative Code* .

Table B.33. Critical Means for Waste Management Area C for FY 2008 Comparisons[a]

Constituent, unit	n	df	t_c	Average Background	Standard Deviation	Critical Mean	Upgradient/ Downgradient Comparison Value
Specific conductance, µS/cm	8	7	5.7282	660.0	43.11	922	922
Field pH	8	7	6.4295	8.10	0.11	[7.32, 8.87]	[7.32, 8.87]
Total organic carbon,[b] µg/L	8	7	5.7282	707.0	443.91	3,404	3,404
Total organic halides,[b] µg/L	8	7	5.7282	7.13	4.61	35.1	35.1

(a) Based on quarterly/semiannual sampling events from December 2005 to June 2007 for upgradient wells 299-E27-22 and 299-E27-7.
(b) For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical means calculation.
df = Degrees of freedom (n-1).
n = Number of background replicate averages.
t_c = Bonferroni critical t-value for appropriate df and 28 comparisons.

Table B.34. Monitoring Wells and Constituents for Waste Management Area S-SX (adapted from PNNL-12114-ICN-3)

Well Number[a]	WAC Compliant	RCRA Parameters: Chromium (filtered)	RCRA Parameters: Nitrate	Supporting Constituents: Alkalinity	Anions	Metals (filtered)	Technetium-99[b]	Tritium[b]	Uranium[b]	Gamma[b]	Sampled as Scheduled in FY 2007
299-W22-44	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-45	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-47	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-48	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-49	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-50	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-69	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-72	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-80	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-81	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-82	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-83	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-84	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-85	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-86	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W23-15	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W23-19	C	Q	Q	Q	Q	Q	Q	A	A	A	Fourth delayed until 10/2007
299-W23-20	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W23-21	C	Q	Q	Q	Q	Q	Q	A	A		Yes

Wells completed at the top of the unconfined aquifer.
(a) ***Bold italic*** = Upgradient well.
(b) *Atomic Energy Act* parameter.
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
Q = To be sampled quarterly.
RCRA = *Resource Conservation and Recovery Act*.
WAC = *Washington Administrative Code*.

Table B.35. Monitoring Wells and Constituents for Waste Management Area T (adapted from PNNL-15301)

			Constituents of Concern		Constituents of Interest and Supporting Groundwater Quality Constituents									
Well Number[a]	Comment	WAC Compliant	Chromium (total, filtered)	Nitrate	Alkalinity	Anions	Gamma Scan[b]	Gross Alpha[b]	Gross Beta[b]	Iodine-129[b]	Metals (filtered)[b]	Technetium-99[b]	Tritium[b]	Sampled as Scheduled in FY 2007
299-W10-1		P	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W10-4		P	Q	Q	Q	Q	A	A	A		Q	Q	Q	Yes
299-W10-8		P	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W10-22		C	S	S	S	S					S	S	S	Yes
299-W10-23		C	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W10-24		C	Q	Q	Q	Q	S	S	S		Q	Q	Q	Yes
299-W10-28		C	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W11-7		P	S	S	S	S					S	S	S	Yes
299-W11-12		P	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W11-39		C	Q	Q	Q	Q	S	S	S		Q	Q	Q	Yes
299-W11-40		C	Q	Q	Q	Q		A	A		Q	Q	Q	Yes
299-W11-41		C	Q	Q	Q	Q	S	S	S	A	Q	Q	Q	Yes
299-W11-42		C	Q	Q	Q	Q	S	S	S		Q	Q	Q	Yes
299-W11-45	Screened 8.5 to 13 m below water table	C	Q	Q	Q	Q	A	A	A		Q	Q	Q	Yes
299-W11-46	Screened 6 to 12 m below water table	C	Q	Q	Q	Q	S	S	S		Q	Q	Q	Yes
299-W11-47	Screened 9.1 to 18.2 m below water table	C	Q	Q	Q	Q	S	S	S	A	Q	Q	Q	Sampled 3 times

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) ***Bold italic*** = Upgradient well.
(b) *Atomic Energy Act* parameter.
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
P = Constructed prior to WAC requirements.
Q = To be sampled quarterly.
S = To be sampled semiannually.
WAC = *Washington Administrative Code*.

Table B.36. Monitoring Wells and Constituents for Waste Management Area TX-TY (adapted from PNNL-16005)

Well Number[(a)]	Comment	WAC Compliant	RCRA Parameters			AEA Parameters							Sampled as Scheduled in FY 2007
			Alkalinity	Anions	Metals (filtered)	Alpha	Beta	Gamma	Iodine-129	Strontium-90	Technetium-99	Tritium	
299-W10-26		C	Q	Q	Q	A	A	A			Q	Q	Yes
299-W10-27		C	Q	Q	Q	A	A	A			Q	Q	Yes
299-W14-6		P	Q	Q	Q	A	A				Q	Q	Yes
299-W14-11	Screened 11 to 14.6 m below water table	C	Q	Q	Q	S	S	S	Q	A	Q	Q	Yes
299-W14-13		C	Q	Q	Q	S	S	S	Q	A	Q	Q	Yes
299-W14-14		C	Q	Q	Q	A	A	A			Q	Q	Yes
299-W14-15		C	Q	Q	Q	A	A	A	Q		Q	Q	Yes
299-W14-16		C	Q	Q	Q				Q		Q	Q	Yes
299-W14-17		C	Q	Q	Q				Q		Q	Q	Yes
299-W14-18		C	Q	Q	Q	A	A	A	Q		Q	Q	Yes
299-W14-19		C	Q	Q	Q	A	A	A			Q	Q	Yes
299-W15-40	Extraction well	C	Q	Q	Q	A	A				Q	Q	Yes
299-W15-41		C	Q	Q	Q	A	A	A	S		Q	Q	Yes
299-W15-44	Extraction well	C	Q	Q	Q	A	A	A	S		Q	Q	Yes
299-W15-763		C	Q	Q	Q	A	A	A			Q	Q	Yes
299-W15-765	Extraction well	C	Q	Q	Q	A	A	A	S		Q	Q	Yes

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) ***Bold italic*** = Upgradient well.
A = To be sampled annually.
AEA = *Atomic Energy Act* .
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
P = Constructed prior to WAC requirements.
Q = To be sampled quarterly.
RCRA = *Resource Conservation and Recovery Act* .
S = To be sampled semiannually.
WAC = *Washington Administrative Code* .

Table B.37. Monitoring Wells and Constituents for Waste Management Area U (adapted from PNNL-13612-ICN-2)

		RCRA Parameters			AEA Parameters				
Well Number[(a)]	WAC Compliant	Alkalinity	Anions	Metals (filtered)	Alpha	Beta	Gamma	Technetium-99	Sampled as Scheduled in FY 2007
299-W18-30	C	Q	Q	Q	A	A	A	Q	Yes
299-W18-31	C	Q	Q	Q	A	A	A	Q	Sampled three times, then went dry
299-W18-40	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-12	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-41	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-42	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-44	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-45	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-47	C	Q	Q	Q	A	A	A	Q	Yes

Wells completed at the top of the unconfined aquifer.
(a) ***Bold italic*** = Upgradient well.
A = To be sampled annually.
AEA = *Atomic Energy Act*.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
Q = To be sampled quarterly.
RCRA = *Resource Conservation and Recovery Act*.
WAC = *Washington Administrative Code*.

Table B.38. Monitoring Wells and Constituents for the KE and KW Basins (adapted from PNNL-14033)

Well Number	Comment	WAC Compliant	Alpha	Anions	Beta	Carbon-14	Metals (filtered)	Strontium-90	Technetium-99	Tritium	Alkalinity	Uranium (total)	VOA	Sampled as Scheduled in FY 2007
KE Basin														
199-K-27		P	Q/M	Q	Q/M		S	A/S	A/Q	Q/M	0/S	0/S		Yes
199-K-29		P	Q/M	Q	Q/M	A/S	A/S	0/S	0/Q	M	0/S			Missed one tritium
199-K-30		P	Q	Q	Q	A/S	S		0/S	Q	0/S			Yes
199-K-32A		C	Q	Q	Q	A/S	A/S		A/S	Q	0/S			Yes
199-K-109A		C	Q/M	Q	Q/M		S	A	A/Q	Q/M	0/S			Yes
199-K-110A		C	S	S	S		A/S			S	0/S			Yes
199-K-111A		C	Q/M	Q	Q/M	A	A/S		A/S	Q/M	0/S			Yes
199-K-141	New well	C	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q			Sampled twice; no Sr-90
199-K-142	New well	C	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q			Sampled twice; no Sr-90
KW Basin														
199-K-31	Not included in monitoring plan	P	0/S	0/S	0/S		0/S		0/A	0/S	0/A			Yes
199-K-34		C	Q	Q	Q	A	S/Q	A	A	Q	0/A	0/A		Yes
199-K-106A		C	Q	Q	Q	A/S	S/Q		0/Q	Q	0/S		0/S	Yes
199-K-107A		C	Q	Q	Q	A	S/Q	A	A	Q	0/A	0/A		Yes
199-K-108A		C	S	S	S	0/S	S			S	0/S			Yes
199-K-132		C	S/Q	S/Q	S/Q	A/S	S/Q		0/S	S/Q	0/S		0/S	Yes

Frequency required under monitoring plan is listed first. Some constituents are sampled more frequently during basin cleanout; those frequencies are listed after the slash. For example, 0/Q means not required under monitoring plan but currently sampled quarterly.

Wells completed at the top of the unconfined aquifer.
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
M = To be sampled monthly.
P = Constructed prior to WAC requirements.
Q = To be sampled quarterly.
S = To be sampled semiannually.
VOA = Volatile organic analyses.
WAC = *Washington Administrative Code* .

Table B.39. Monitoring Wells, Constituents, and Enforcement Limits for 200 Area Treated Effluent Disposal Facility (adapted from PNNL-13032)

		Constituents with Enforcement Limits			Other Constituents								
Well[(a)]	WAC Compliant	pH (6.5 – 8.5)	Cadmium[(b)] (5 µg/L)	Lead[(b)] (10 µg/L)	Specific Conductance	Alpha	Anions	Beta	Metals[(b)]	Total Dissolved Solids	Trace Metals[(b)]	Tritium	Sampled as Scheduled in FY 2007
699-40-36	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	A	Yes
699-41-35	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	A	Yes
699-42-37	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	A	Yes

All wells completed at the top of the Ringold Formation confined aquifer.
(a) ***Bold italic*** = Upgradient well.
(b) Filtered and unfiltered samples.
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
Q = To be sampled quarterly.
WAC = *Washington Administrative Code* .

Table B.40. Monitoring Wells and Constituents for Environmental Restoration Disposal Facility (adapted from BHI-00873)

Well Number[(a)]	WAC Compliant	Alkalinity	Alpha	Anions	Beta	Carbon-14	Iodine-129	Metals (filtered, unfiltered)	Radium[(b)]	Total Dissolved Solids	Technetium-99	Total Organic Halides	Uranium	Volatile Organic Analyses	Sampled as Scheduled in FY 2007
699-35-66A	C	S	S	S	S	S	S	S	S	S	S	S	S	S	Yes
699-36-67	C	S	S	S	S	S	S	S	S	S	S	S	S	S	Yes
699-36-70A	P	S	S	S	S	S	S	S	S	S	S	S	S	S	Yes
699-37-68	C	S	S	S	S	S	S	S	S	S	S	S	S	S	Yes

Wells completed at the top of the unconfined aquifer.
(a) ***Bold italic*** = Upgradient well.
(b) Total alpha energy emitted from radium
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
P = Constructed prior to WAC requirements.
S = To be sampled semiannually.
WAC = *Washington Administrative Code* .

Table B.41. Monitoring Wells and Constituents for 600 Area Central Landfill (adapted from PNNL-13014)

			Required Parameters (WAC 173-304-490)														Other Parameters				
Well Number[(a)]	Comment	WAC Compliant	Ammonia	Chemical Oxygen Demand	Chloride	Iron (filtered)	Manganese (filtered)	Zinc (filtered)	Nitrate	Nitrite	pH (field)	Spec. Cond. (field)	Sulfate	Temperature (field)	Coliform	Total Organic Carbon	Anions	Metals (filtered)	Arsenic (filtered)	Volatile Organic Analyses	Sampled as Scheduled in FY 2007
699-22-35		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-23-34A		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-23-34B		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-33	Information only; no statistics	P	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-34A		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-34B		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-34C		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-35		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-26-35A		C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes

Wells completed at the top of the unconfined aquifer.
(a) ***Bold italic*** = Upgradient well.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
P = Constructed prior to WAC requirements.
Q = To be sampled quarterly.
Spec. Cond. = Specific conductance.
WAC = *Washington Administrative Code*.

Table B.42. Analytical Results for Required Constituents[a] at 600 Area Central Landfill

Constituent, unit	Background Threshold Value [b]	Date	Well 699-22-35	Well 699-23-34A	Well 699-23-34B	Well 699-24-33	Well 699-24-34A	Well 699-24-34B	Well 699-24-34C	Well 699-24-35	Well 699-26-35A
Ammonium, ug/L	90 µg/L	Dec. 2006 [c]	13	15.1	<6.69	<6.69	<6.69	34.3	<6.69	<6.69	<6.69
		Feb. 2007	13.1	13.5	9.92	<2.58	8.76	9.79	10	30.5	19.2
		May. 2007	11.9	11.9	13.3	13.5	8.15	11.9	11.9	11.9	12.6
		Sep. 2007	<6.08	<6.08	<6.08	[d]	<6.08	<6.08	<6.08	<6.08	[d]
Chemical oxygen demand, mg/L	10 mg/L	Dec. 2006 [c]	**285** [e]	**13**	**17**	<14.3	**15**	<9.2	**13**	<14.4	**22**
		Feb. 2007	<10	10	<10	<10	<10	<10	<10	<10	<10
		May. 2007	<14.4	<14.4	**27**	<14.4	<14.4	<14.4	**31**	**17**	**62**
		Sep. 2007	<10	<10	<10	[d]	<10	<10	<10	<10	[d]
Chloride, mg/L	7.8 mg/L	Dec. 2006 [c]	7.6	4.7	7.1	**8.4** [e]	7.8	4.7	2.9	7.8	**8.6** [e]
		Feb. 2007	7.7	**9.6** [e]	**9.7** [e]	5.1	**9.1** [e]	7.4	5.1	**9.3** (e)	7.7
		May. 2007	6	5.8	5.3	5.8	6.3	5.9	5.7	5.4	6.3
		Sep. 2007	6.82	7.08	6.71	[d]	6.87	7.2	6.7	6.2	[d]
Coliform Bacteria, col/100ml	1 col/100ml	Dec. 2006 [c]	<1	**345** [e]	<1	<1	<1	<1	<1	<1	<1
		Feb. 2007	<1	<1	<1	<1	<1	<1	<1	<1	<1
		May. 2007	<1	<1	<1	**14.8** [e]	<1	<1	<1	<1	**14.8** [e]
		Sep. 2007	[d]	[d]	[d]	[d]	[d]	[d]	[d]	[d]	[d]
Iron, filtered, ug/L	160 µg/L	Dec. 2006 [c]	34.2	42	34.7	34.1	38.5	32	37	33.1	29.7
		Feb. 2007	39	51.1	51.9	31.2	47	51	43.6	29.6	<25
		May. 2007	43.5	99.6	47.7	29.8	31.7	66.3	43.6	32.8	29
		Sep. 2007	<37.2	<37.2	<37.2	[d]	126	<37.2	72.2	<37.2	d
Manganese, ug/L	11 µg/L	Dec. 2006 [c]	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
		Feb. 2007	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
		May. 2007	<2.5	<2.5	<2.5	<2.5	<2.5	4.1	6.8	<2.5	<2.5
		Sep. 2007	<2.1	<2.1	<2.1	[d]	<2.1	<2.1	<2.1	<2.1	[d]
Nitrate, mg/L	29 mg/L	Dec. 2006 [c]	15.5	16.4	15.1	13.3	12.8	14.2	13.7	12.4	16.4
		Feb. 2007	17.3	17.3	16.4	14.6	14.2	14.6	13.7	12.4	16.8
		May. 2007	17.3	18.1	16.4	13.7	12.8	15.1	12.8	12.4	16.4
		Sep. 2007	17.6	16.9	16.6	[d]	13.9	16.6	13.7	11.6	[d]
Nitrite, ug/L	59 µg/L	Dec. 2006 [c]	<131	<131	<131	<13.1	<131	<131	<131	<13.1	<13.1
		Feb. 2007	**526** [e]	**1150** [e]	**657** [e]	**558** [e]	**558** [e]	**723** [e]	**887** [e]	**526** [e]	**558** [e]
		May. 2007	<13.1	<13.1	<13.1	<13.1	<13.1	<13.1	<13.1	<13.1	<13.1
		Sep. 2007	<32.8	<32.8	<32.8	[d]	<32.8	<32.8	<32.8	<32.8	[d]
Field pH	6.68-7.84	Dec. 2006 [c]	6.95	**6.63**	6.7	6.87	6.71	6.71	6.86	6.94	7.27
		Feb. 2007	7.14	6.69	6.76	6.84	6.71	6.71	6.91	6.74	7.21
		May. 2007	6.91	**6.49**	6.68	6.86	6.74	6.7	6.97	6.86	7.2
		Sep. 2007	6.94	6.68	6.73	[d]	6.77	6.73	6.98	6.83	[d]

Table B.42. (contd)

Constituent, unit	Background Threshold Value [b]	Date	Well 699-22-35	Well 699-23-34A	Well 699-23-34B	Well 699-24-33	Well 699-24-34A	Well 699-24-34B	Well 699-24-34C	Well 699-24-35	Well 699-26-35A
Specific conductance, uS/cm	583 µS/cm	Dec. 2006 [c]	**829**	**698**	**762**	**766**	**661**	**708**	**655**	576	545
		Feb. 2007	**826**	**748**	**755**	**755**	**656**	**695**	**725**	565	538
		May. 2007	**809**	**739**	**658**	**744**	**767**	**689**	**730**	560	526
		Sep. 2007	**831**	**619**	**779**	[d]	**678**	**723**	**715**	**591**	[d]
Sulfate, mg/L	47.2 mg/L	Dec. 2006 [c]	42	46.5	42.5	40.8	44.4	46.2	42	41.5	35.1
		Feb. 2007	40	45	42.5	39.9	41.5	44.2	39.6	41.2	35.4
		May. 2007	41.9	47.1	41.1	41.9	45	45.3	39.4	42.3	36.8
		Sep. 2007	42.6	**47.4**	44.9	[d]	44.8	**51.9**	41.7	43.2	[d]
Temperature, °C	20.7 °C	Dec. 2006 [c]	17.8	17.6	17.7	19.4	18.2	17.4	18.2	17.4	19.3
		Feb. 2007	18.2	18.1	17.6	19.2	18.1	18.2	17.7	17.5	19
		May. 2007	18.1	18.7	18.3	19.4	18.5	18.5	18.2	18	19.9
		Sep. 2007	19.4	19.2	**22.2**	[d]	19.7	19.8	19.8	18.7	[d]
Total organic carbon, ug/L	2,700 µg/L	Dec. 2006 [c]	<470	<470	<470	<470	<470	<470	<470	<470	<470
		Feb. 2007	<760	<760	<760	<760	<760	<760	<760	<760	<760
		May. 2007	<470	<760	<760	<760	<760	<760	<760	<760	<760
		Sep. 2007	<470	<760	<760	[d]	<760	<760	<760	<760	[d]
Zinc, ug/L	43.2 µg/L	Dec. 2006 [c]	<9.6	<9.6	<9.6	12.4	<9.6	<9.6	15.6	9.8	<9.6
		Feb. 2007	<5.6	<9.6	<9.6	11.4	<9.6	<9.6	18.3	9.9	<9.6
		May. 2007	<9.6	<9.6	<9.6	13	<9.6	<9.6	14.3	<9.6	<9.6
		Sep. 2007	<19.3	<19.3	<19.3	[d]	<19.3	<19.3	<19.3	<19.3	[d]

(a) WAC 173-304.
(b) Number obtained from Table B.43 of PNNL-16346.
(c) Samples from wells 699-24-33, 699-24-35, and 699-26-35A were collected in January 2007.
(d) Analysis results not yet reported.
(e) Result inconsistent with historical trend. Result under review.
Results in bold exceed background threshold value.

Table B.43. Results of Shapiro and Francia Test for Normality and Background Threshold Values for 600 Area Central Landfill

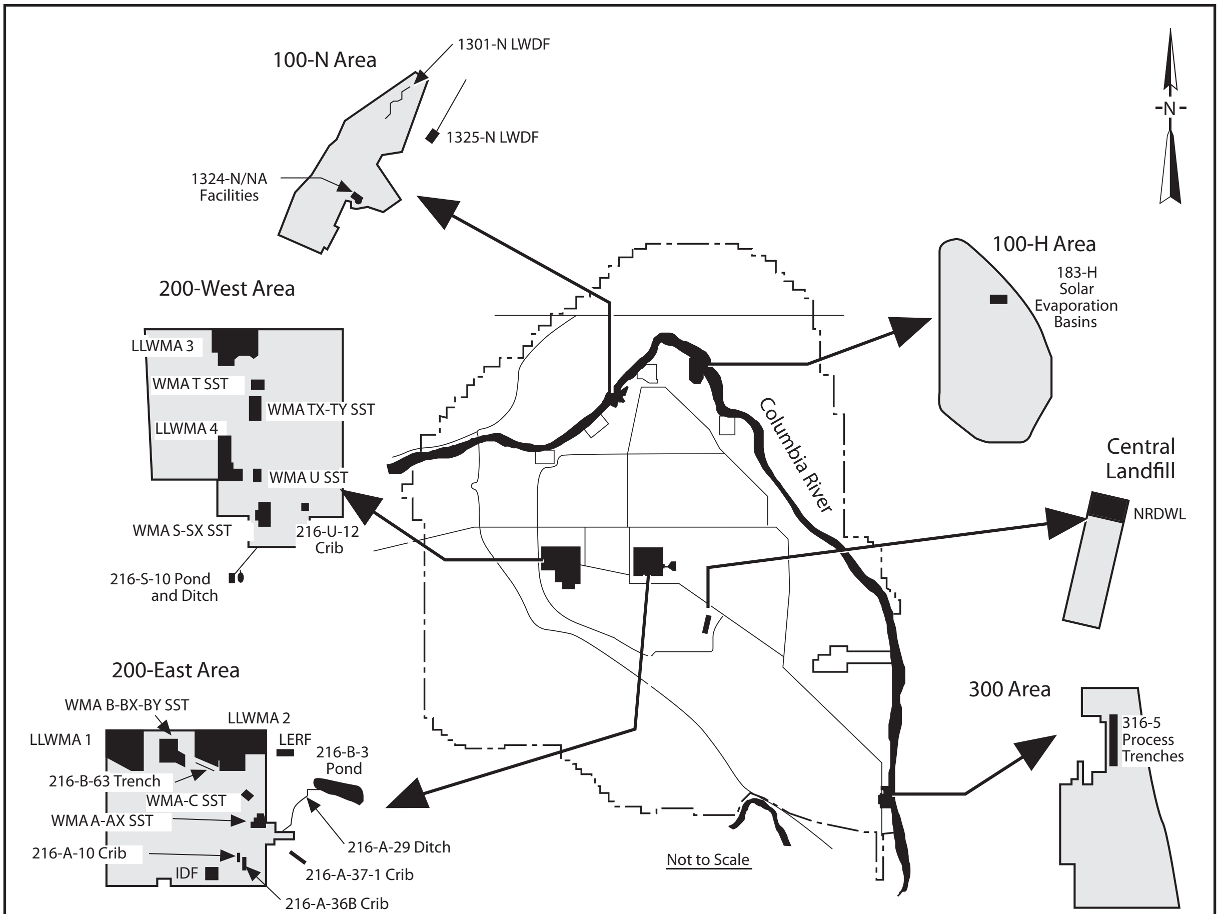
Constituent,[a] unit	W-test Statistic,[b] (log value)	W-test Statistic,[b] (raw data)	W-test[b] Critical Value, Wα[c]	Upper Tolerance Limit	Background Threshold Value
Ammonium (as NH_3^-), μg/L	NC	NC	NC	90[d] 54[e] WSCF 27.5[e] STL	90
Chemical oxygen demand, μg/L	NC	NC	NC	10,000[f]	10,000
Chloride, μg/L	0.954 s	0.962 s	0.963	7,820[d]	7,820
Coliform bacteria, colonies/100 ml	NC	NC	NC	1[f]	1
Field pH	0.988 ns	NA	0.963	[6.68, 7.84][g]	[6.68, 7.84]
Iron, dissolved, μg/L	0.960 s	0.802 s	0.962	160[d] 41[e] WSCF 84[e] STL	160
Manganese, dissolved, μg/L	NC	NC	NC	10[d] 18[e] WSCF 5[e] STL	18
Nitrate (as NO_3^-), μg/L	0.833 s	0.844 s	0.963	29,000[d]	29,000
Nitrite (as NO_2^-), μg/L	NC	NC	NC	148[e] WSCF 72[e] STL	148
Specific conductance, μS/cm	0.978 ns	NA	0.960	583[g]	583
Sulfate, μg/L	0.983 ns	NA	0.963	47,200[g]	47,200
Temperature, °C	0.953 s	0.961 s	0.963	20.7[d]	20.7
Total organic carbon, μg/L	NC	NC	NC	842[d] 1,430[e]	1,430
Zinc, dissolved, μg/L	NC	NC	NC	42.3[d] 18[e] WSCF 43.2[e] STL	43.2

(a) Constituents are specified in WAC 173-304-490(2)(d). Data collected from March 1993 to May 2000 from upgradient wells 699-24-35 and 699-26-35A.
(b) Shapiro and Francia (1972).
(c) Obtained from Table A-9 (Shapiro 1980) for α = 5%.
(d) Maximum value reported.
(e) Based on log-normal distribution.
(f) Based on limit of quantitation determined from field blanks (for total organic carbon) or laboratory blanks.
(g) Based on laboratory lowest detected result.
NA = Not applicable.
NC = Not calculated; insufficient measured values.
ns = Not significant at 0.05 level of significance.
s = Significant at 0.05 level of significance.
STL = Severn Trent Laboratories (St. Louis).
WSCF = Waste Sampling and Characterization Facility.

Table B.44. Monitoring Wells, Constituents, and Enforcement Limits for State-Approved Land Disposal Site (adapted from PNNL-13121)

			Constituents with Enforcement Limits											Other Constituents					
Well	Comment	WAC Compliant	pH (6.5 - 8.5)	Acetone (160 µg/L)	Benzene (5 µg/L)	Cadmium[a] (5 µg/L)	Chloroform (6.2 µg/L)	Copper[a] (70 µg/L)	Lead[a] (10 µg/L)	Mercury[a] (2 µg/L)	Sulfate (250 mg/L)	Tetrahydrofuran (100 µg/L)	Total Dissolved Solids (500 mg/L)	Specific Conductance	Alpha	Beta	Strontium-90	Tritium	Sampled as Scheduled in FY 2007
299-W6-6	Bottom of unconfined	C																A	Yes
299-W6-11		C																A	Yes
299-W6-12		C																A	Yes
299-W7-3	Bottom of unconfined	C																S	Yes
299-W8-1		C																A	Yes
699-48-71	Unconfined	P																A	Yes
699-48-77A	Ringold E, upper	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-48-77C	Ringold E, mid to lower	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-48-77D	Ringold E, upper	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-49-79		P																A	Yes
699-51-75		P																S	Sampled once; pump failure
699-51-75P	Lower unconfined	P																A	Yes

Wells completed at the top of the unconfined aquifer unless specified otherwise.
(a) Filtered and unfiltered samples.
A = To be sampled annually.
C = Well is constructed as a resource protection well under WAC 173-160.
FY = Fiscal year.
P = Constructed prior to WAC requirements.
Q = To be sampled quarterly.
S = To be sampled semiannually.
WAC = *Washington Administrative Code.*



IDF	Integrated Disposal Facility	SALDS	State-Approved Land Disposal Site
LERF	Liquid Effluent Retention Facility	SST	Single-Shell Tank
LLWMA	Low-Level Waste Management Area	SWL	Solid Waste Landfill
LWDF	Liquid Waste Disposal Facility	TEDF	Treated Effluent Disposal Facility
NRDWL	Nonradioactive Dangerous Waste Landfill	WMA	Waste Management Area

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Figure B.1. RCRA Units on the Hanford Site Requiring Groundwater Monitoring

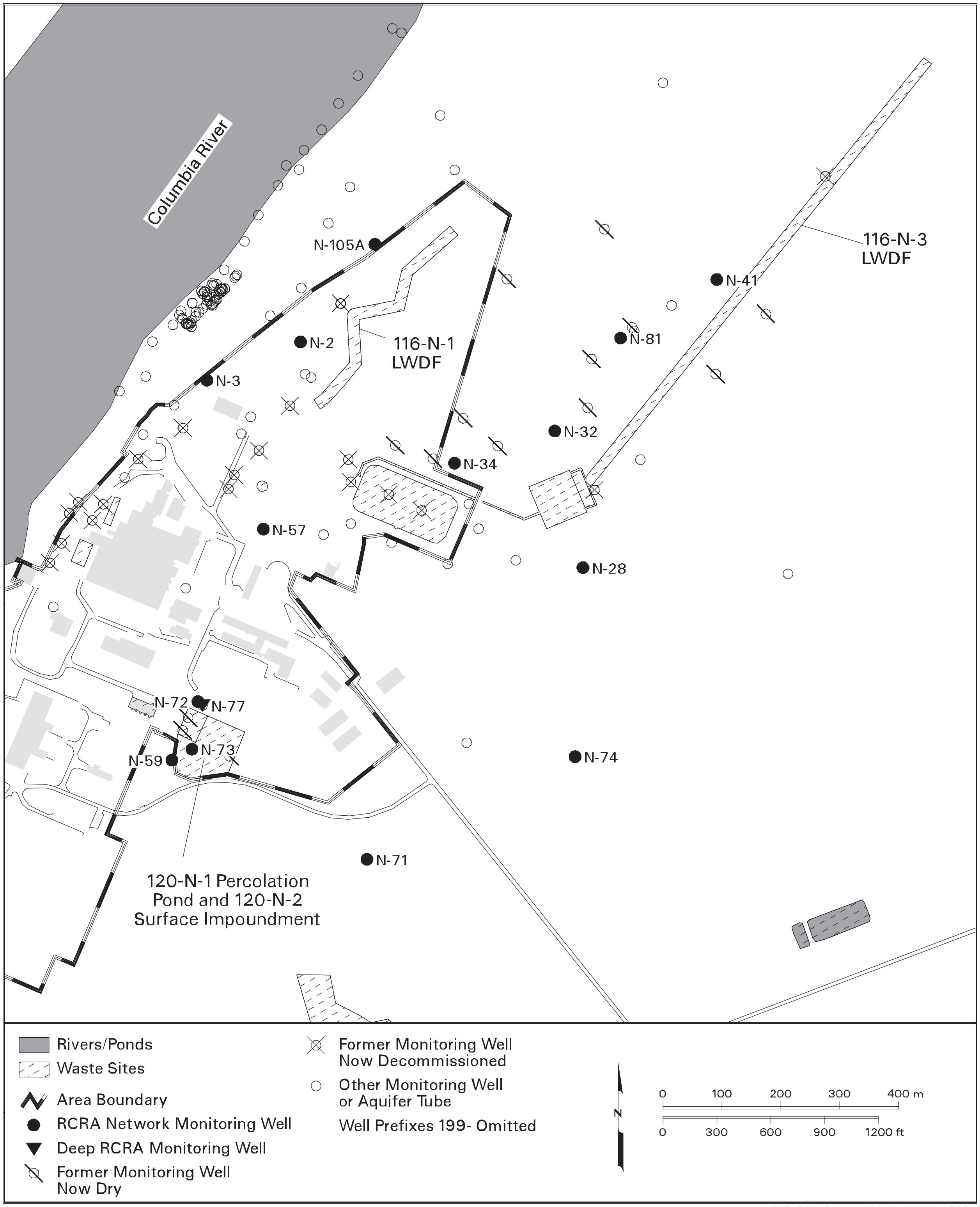

Figure B.2. Groundwater Monitoring Wells for 100-N Area RCRA Sites

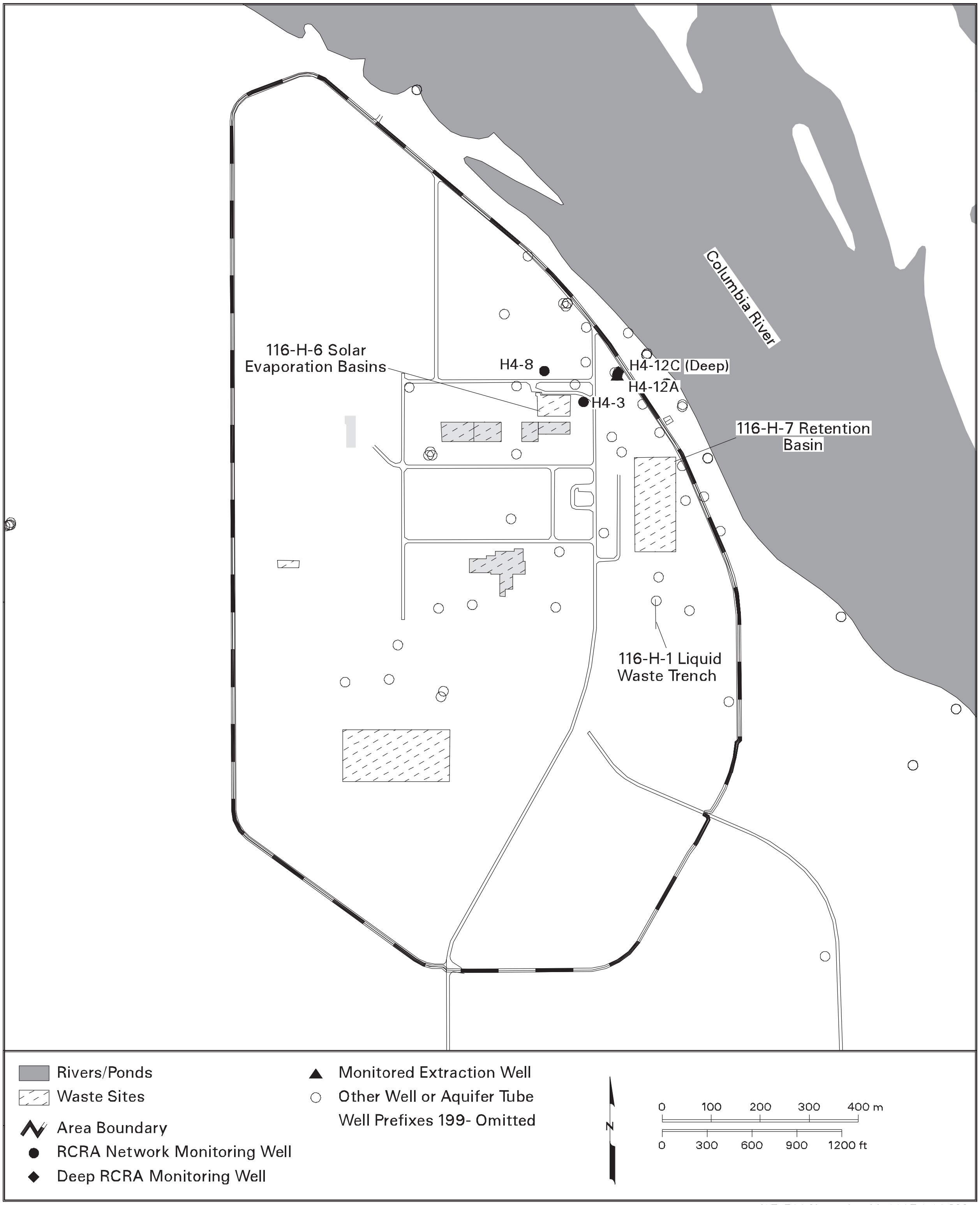

Figure B.3. Groundwater Monitoring Wells at 116-H-6 Evaporation Basins

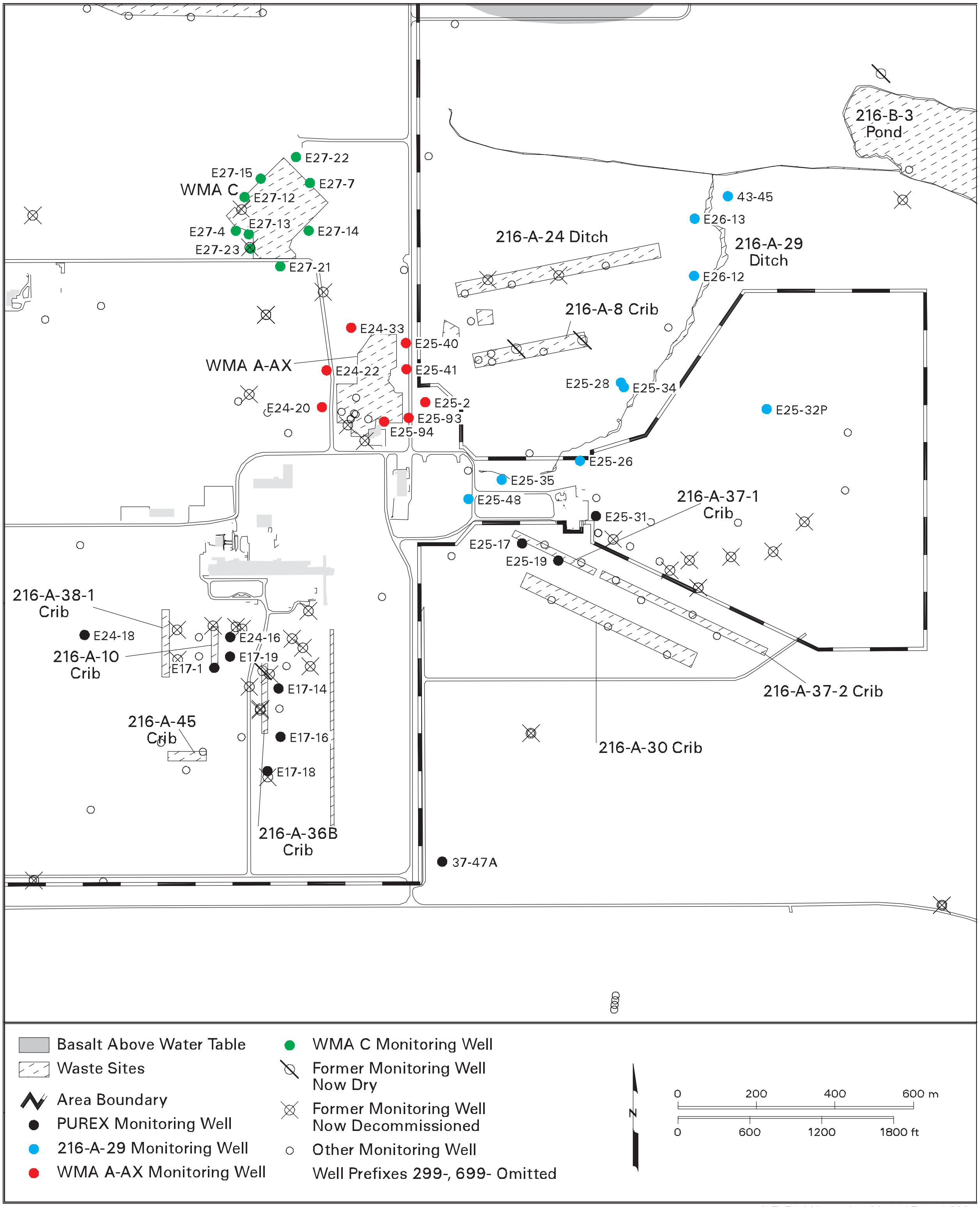

Figure B.4. Groundwater Monitoring Wells at 216-A-29 Ditch, PUREX Cribs, and Waste Management Areas A-AX and C

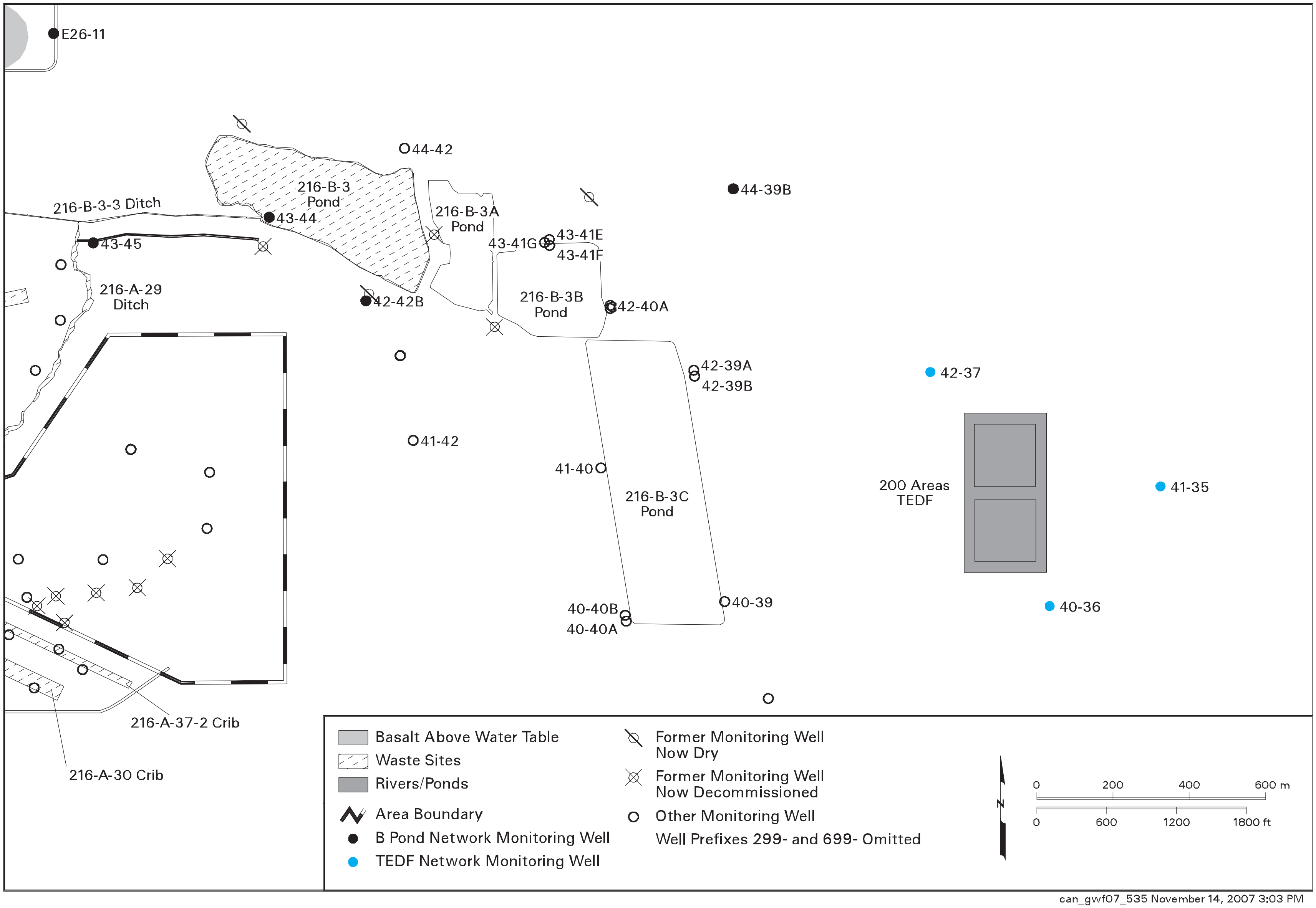

Figure B.5. Groundwater Monitoring Wells at 216-B-3 Pond and 200 Area Treated Effluent Disposal Facility

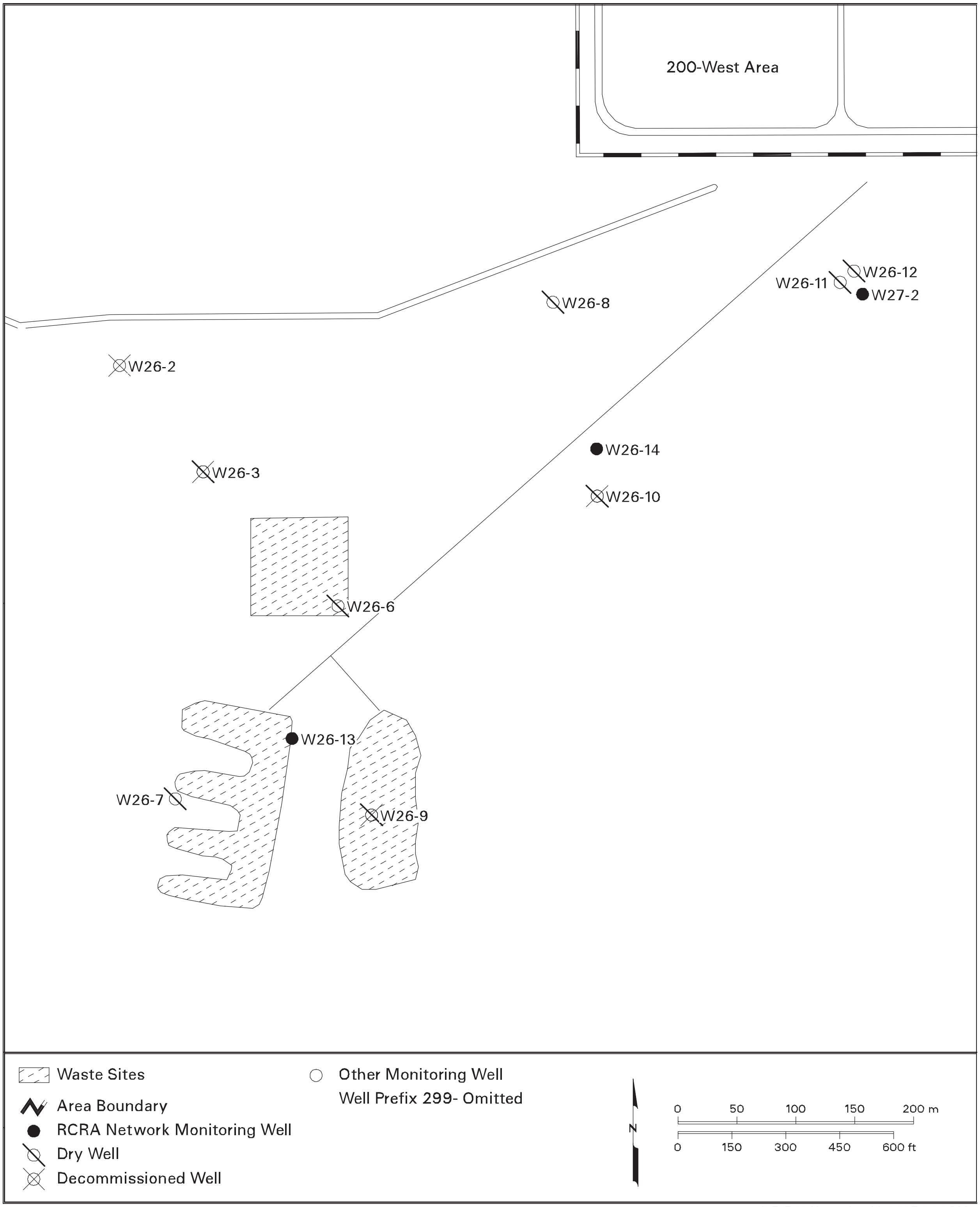

Figure B.6. Groundwater Monitoring Wells at 216-S-10 Pond and Ditch

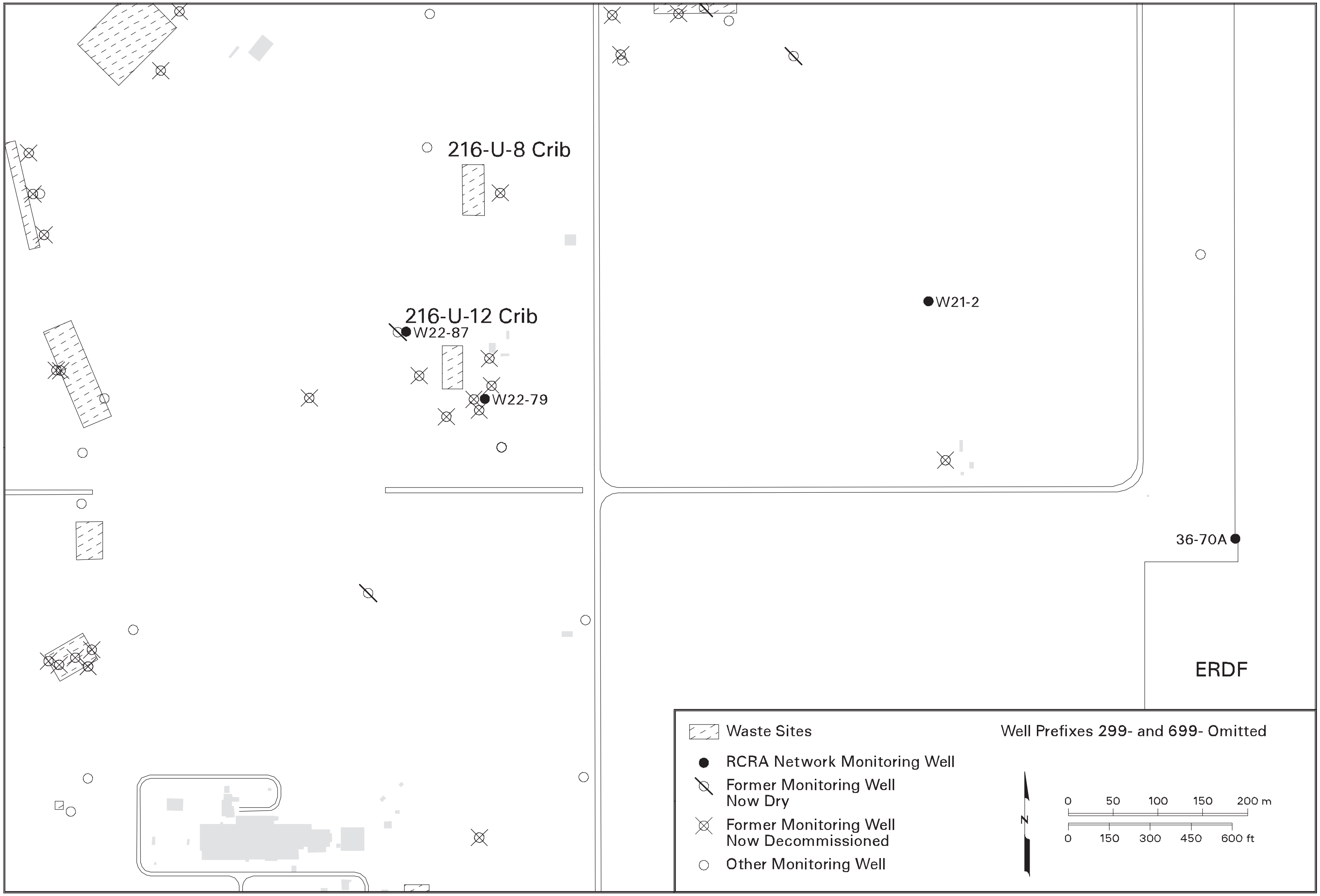

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Figure B.7. Groundwater Monitoring Wells at the 216-U-12 Crib

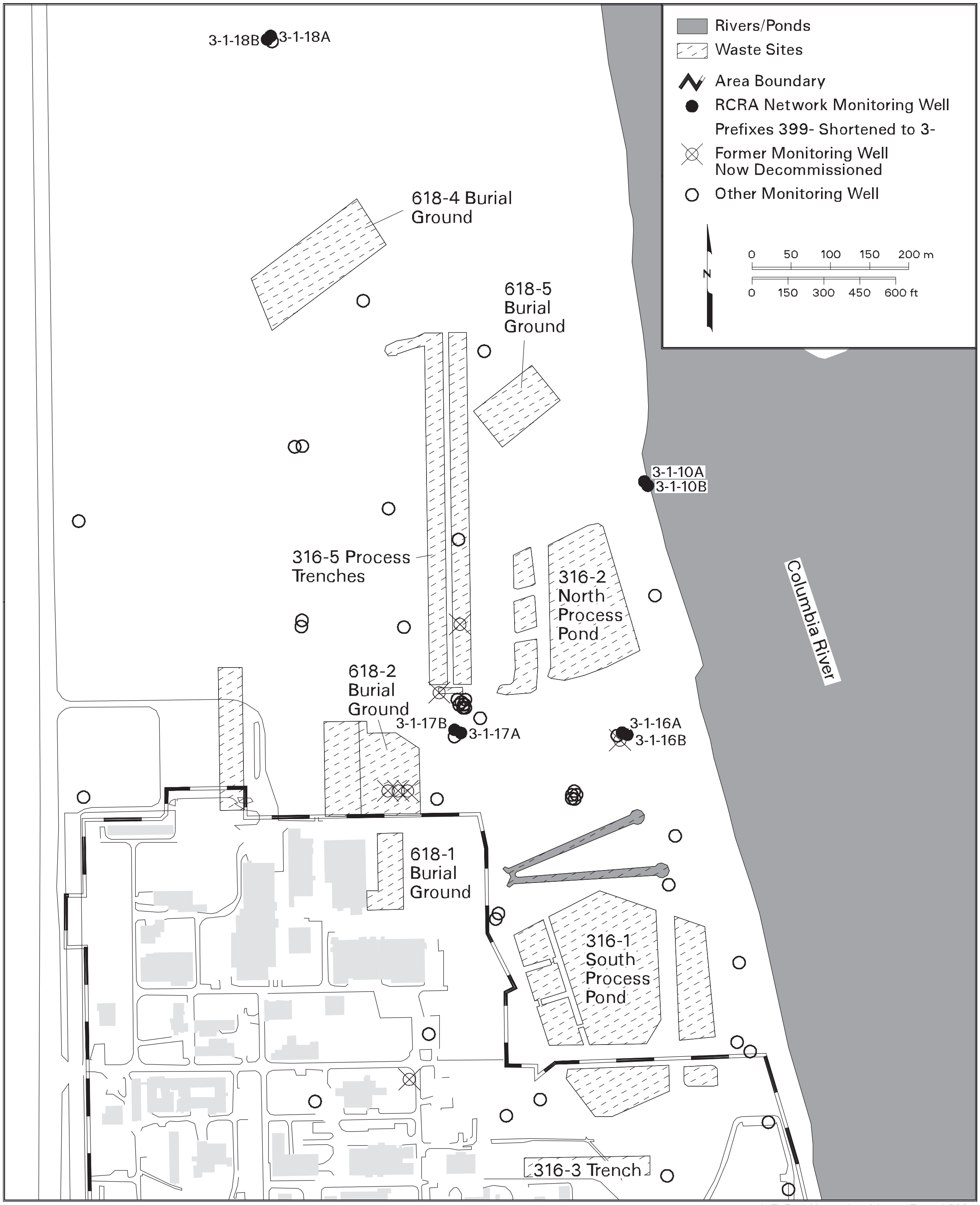

Figure B.8. Groundwater Monitoring Wells at 316-5 Process Trenches

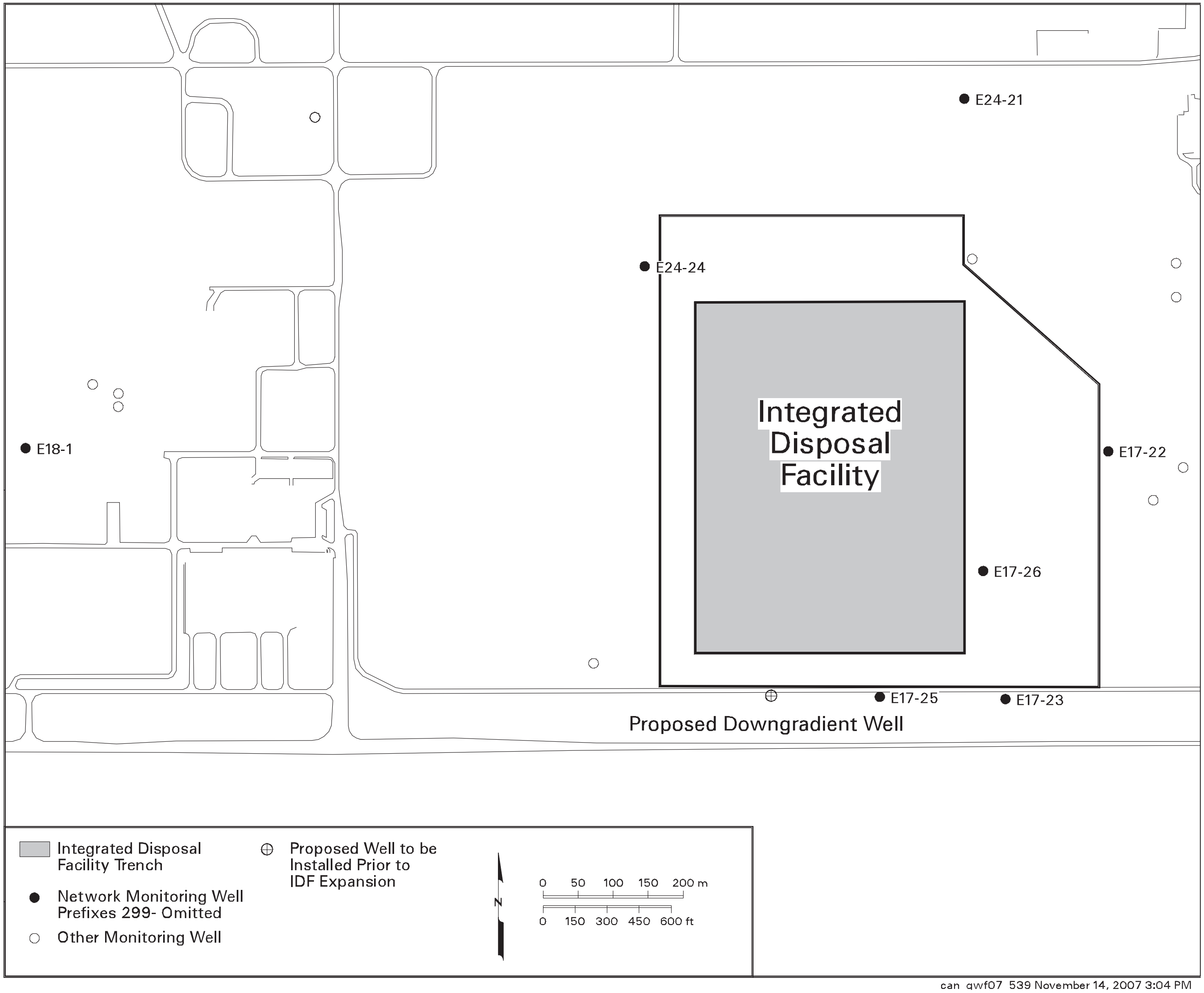

Figure B.9. Groundwater Monitoring Wells at Integrated Disposal Facility

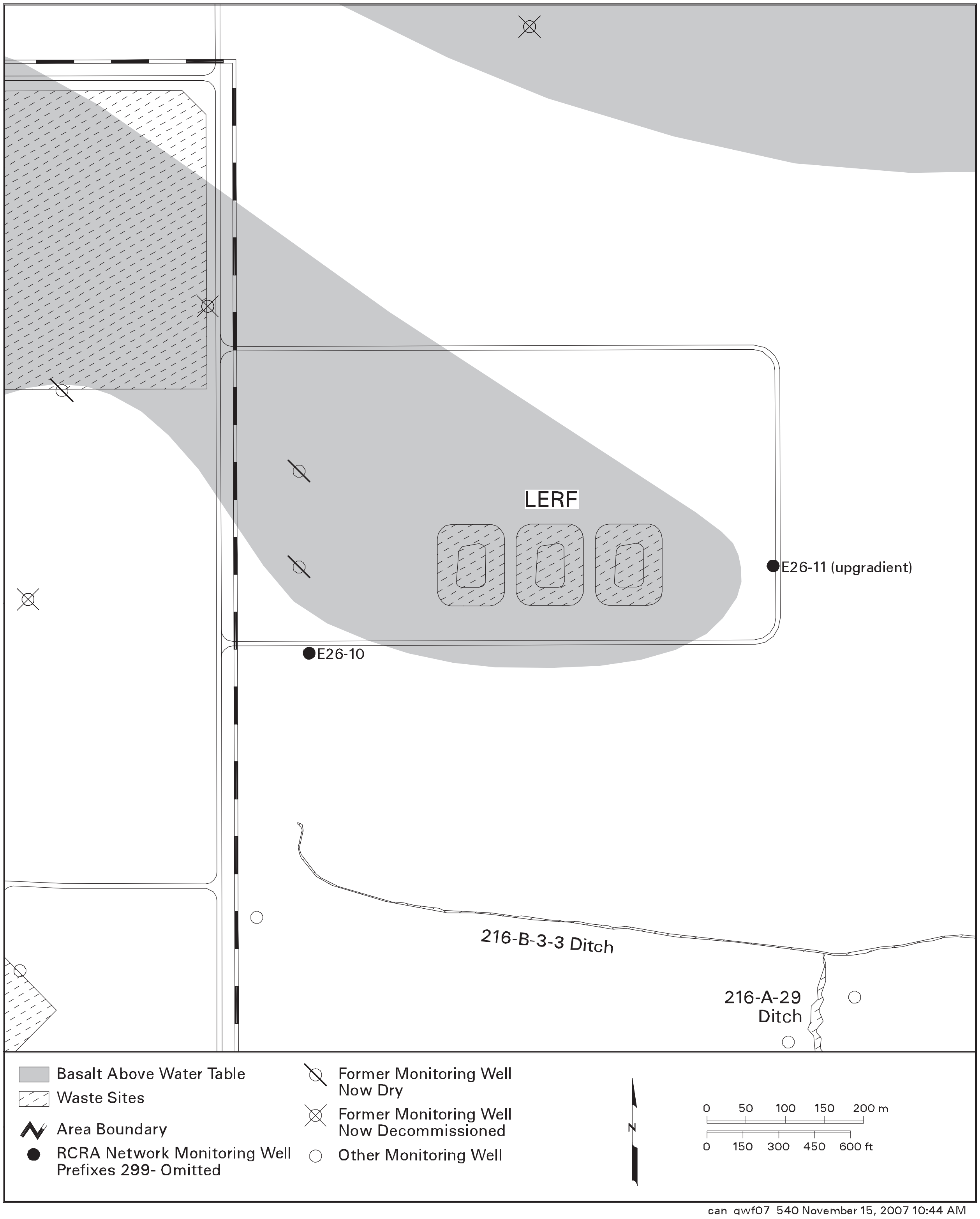

Figure B.10. Groundwater Monitoring Wells at Liquid Effluent Retention Facility

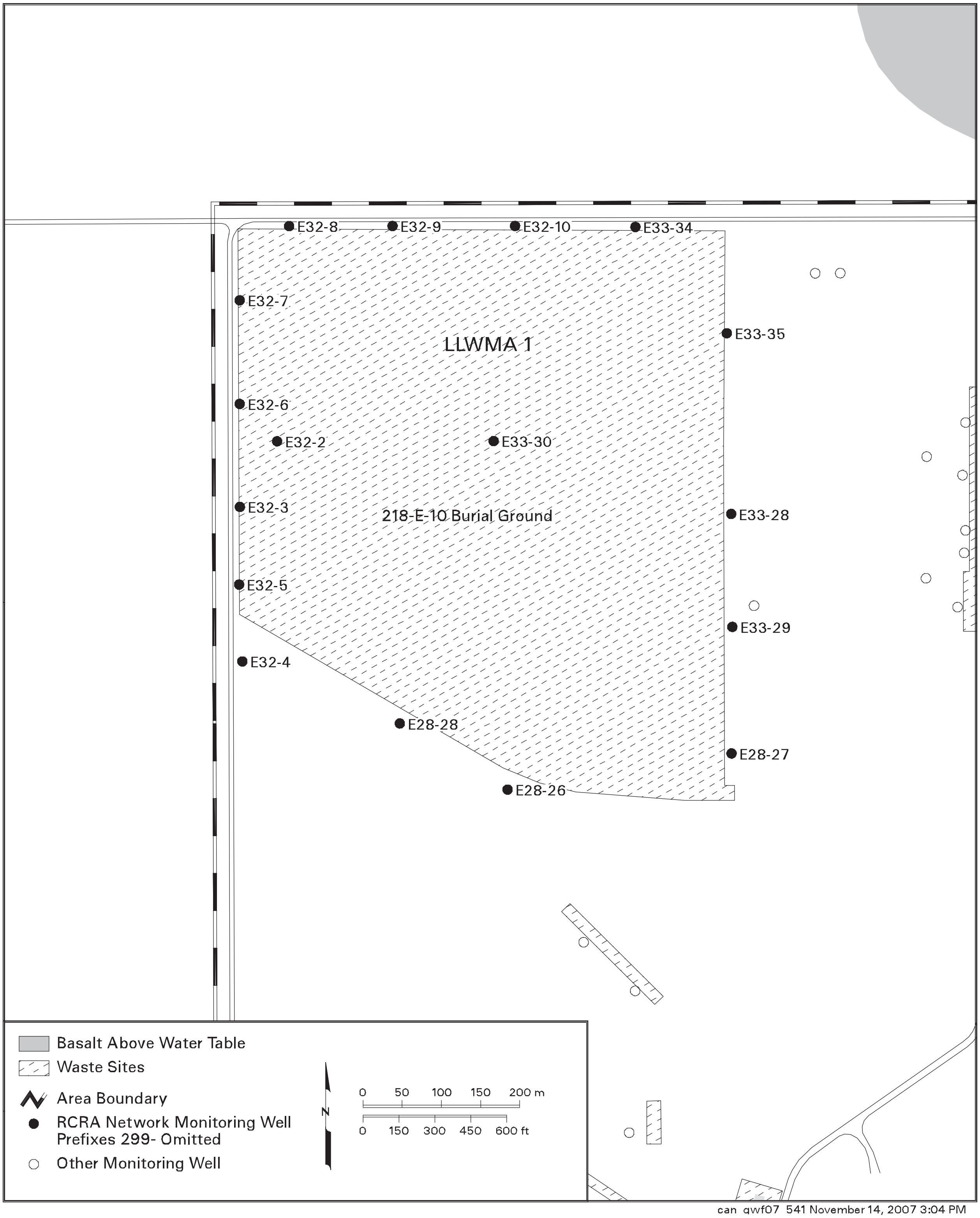

Figure B.11. Groundwater Monitoring Wells at Low-Level Waste Management Area 1

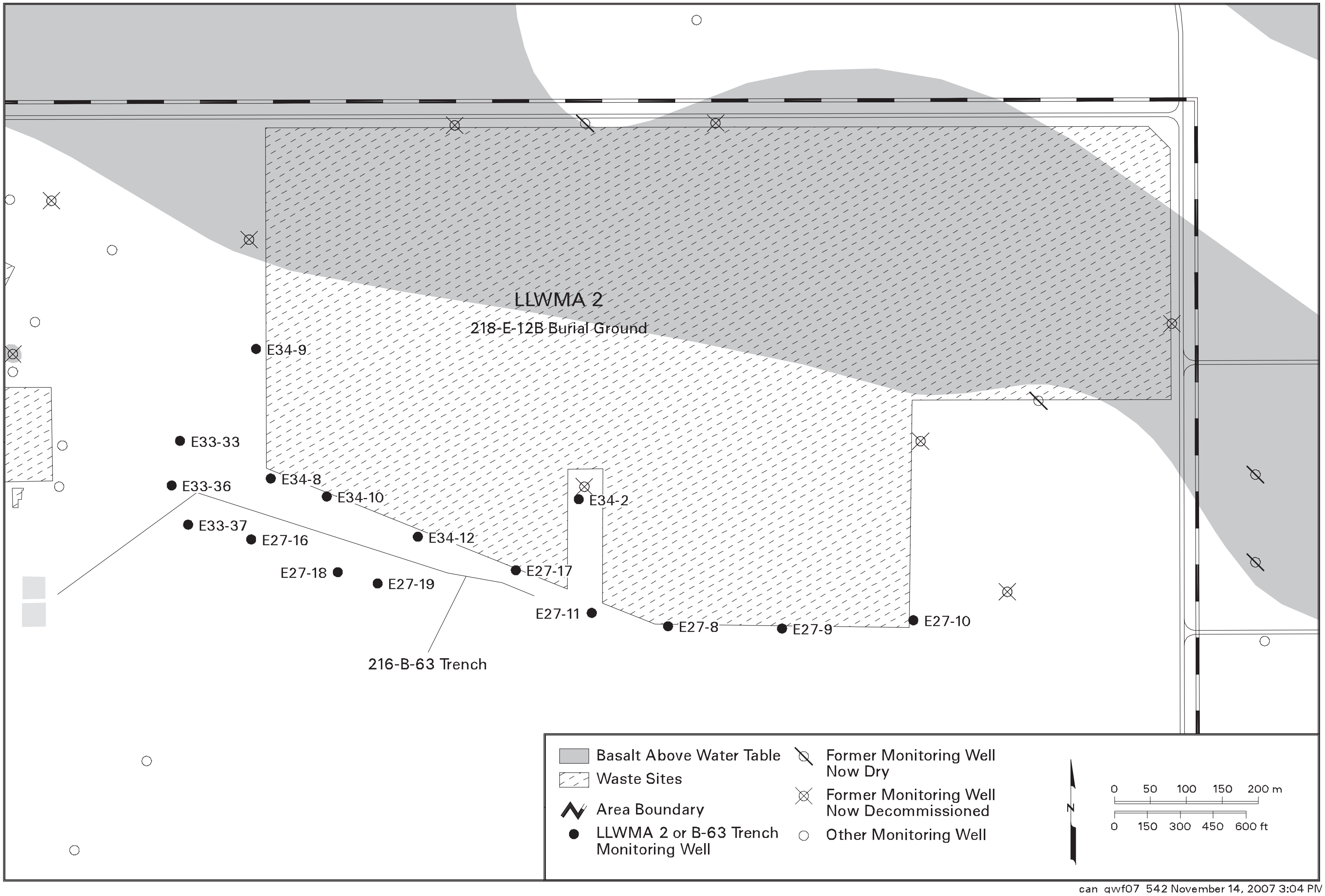

Figure B.12. Groundwater Monitoring Wells at 216-B-63 Trench and Low-Level Waste Management Area 2

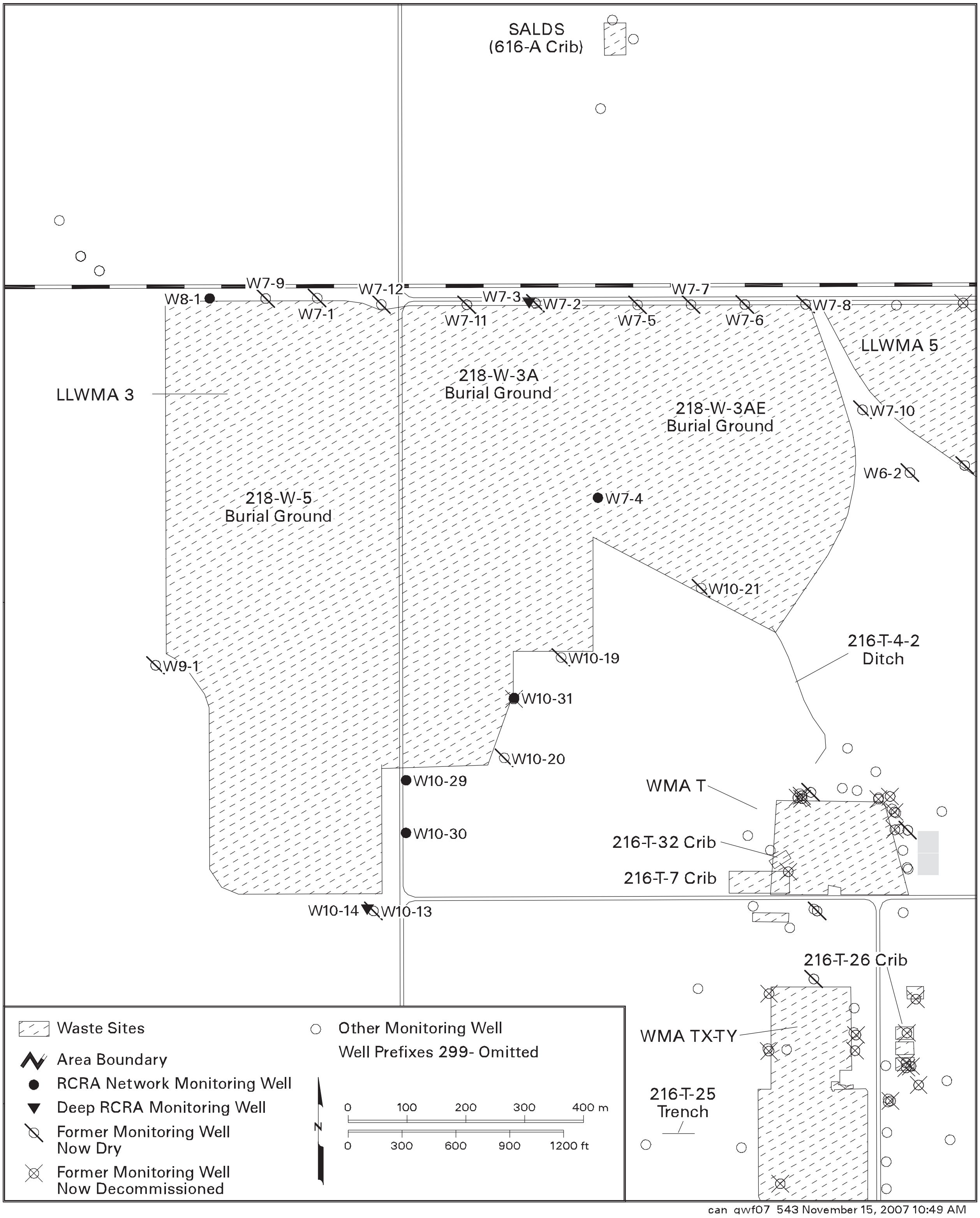

Figure B.13. Groundwater Monitoring Wells at Low-Level Waste Management Area 3

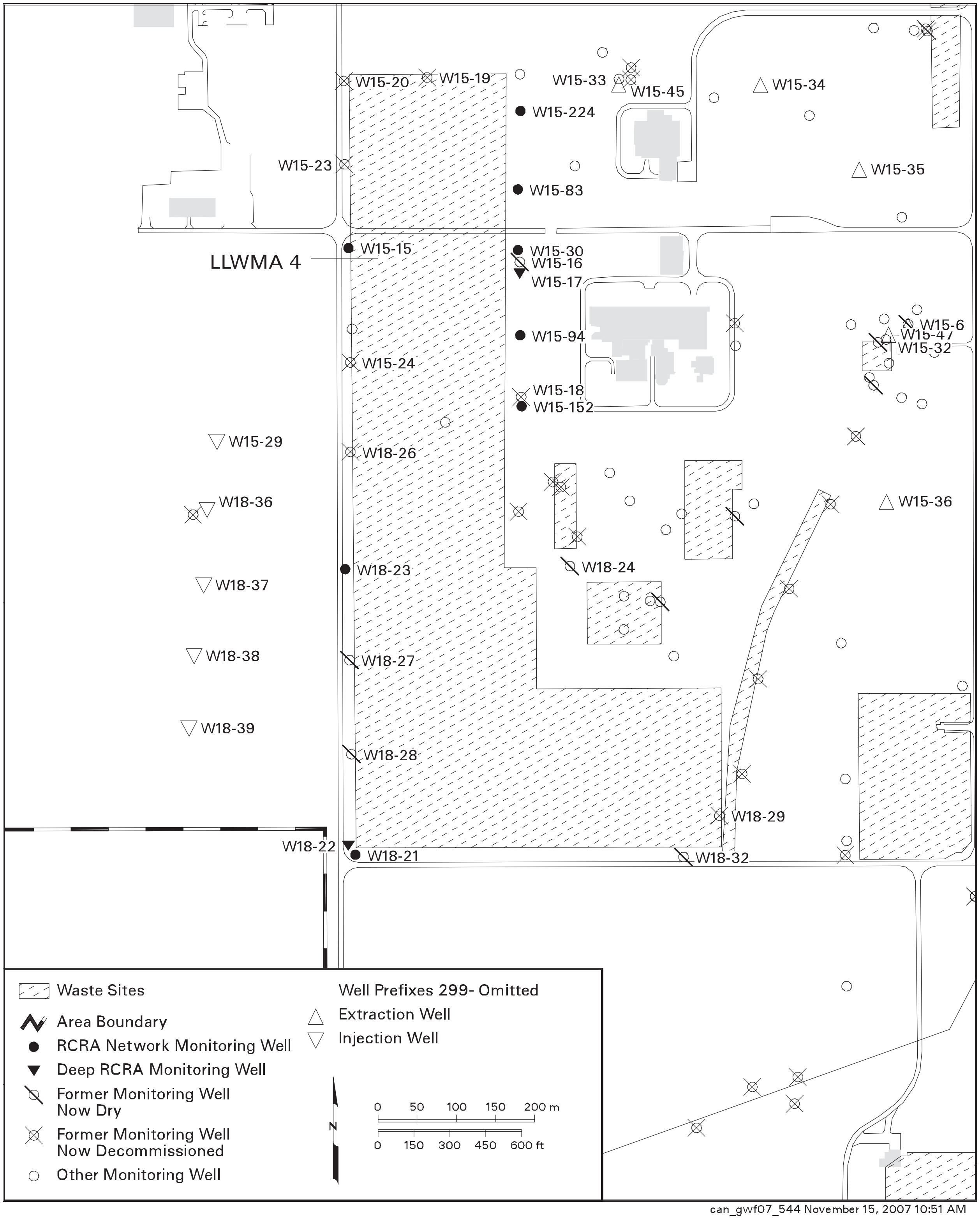

Figure B.14. Groundwater Monitoring Wells at Low-Level Waste Management Area 4

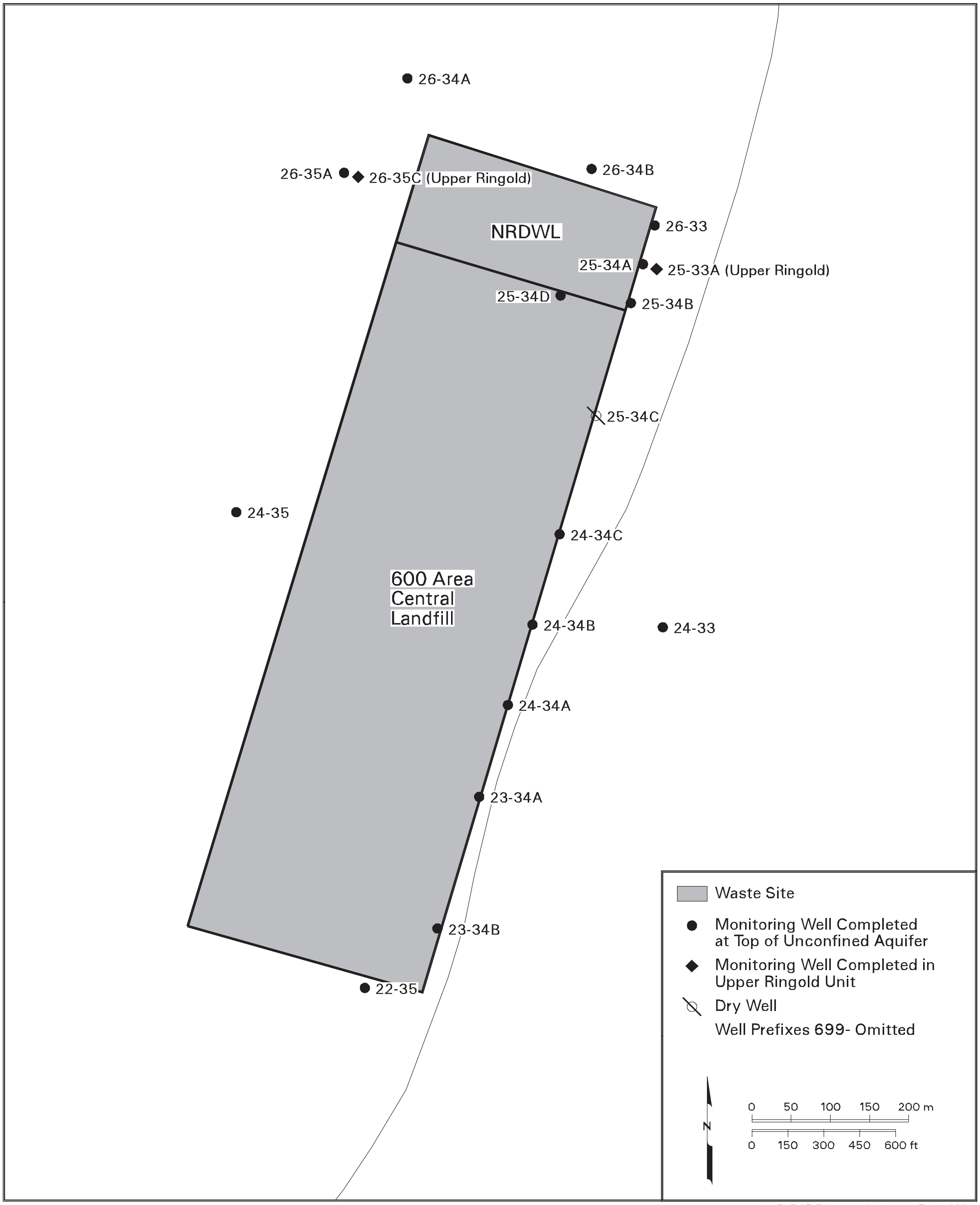

Figure B.15. Groundwater Monitoring Wells at Nonradioactive Dangerous Waste Landfill and 600 Area Central Landfill

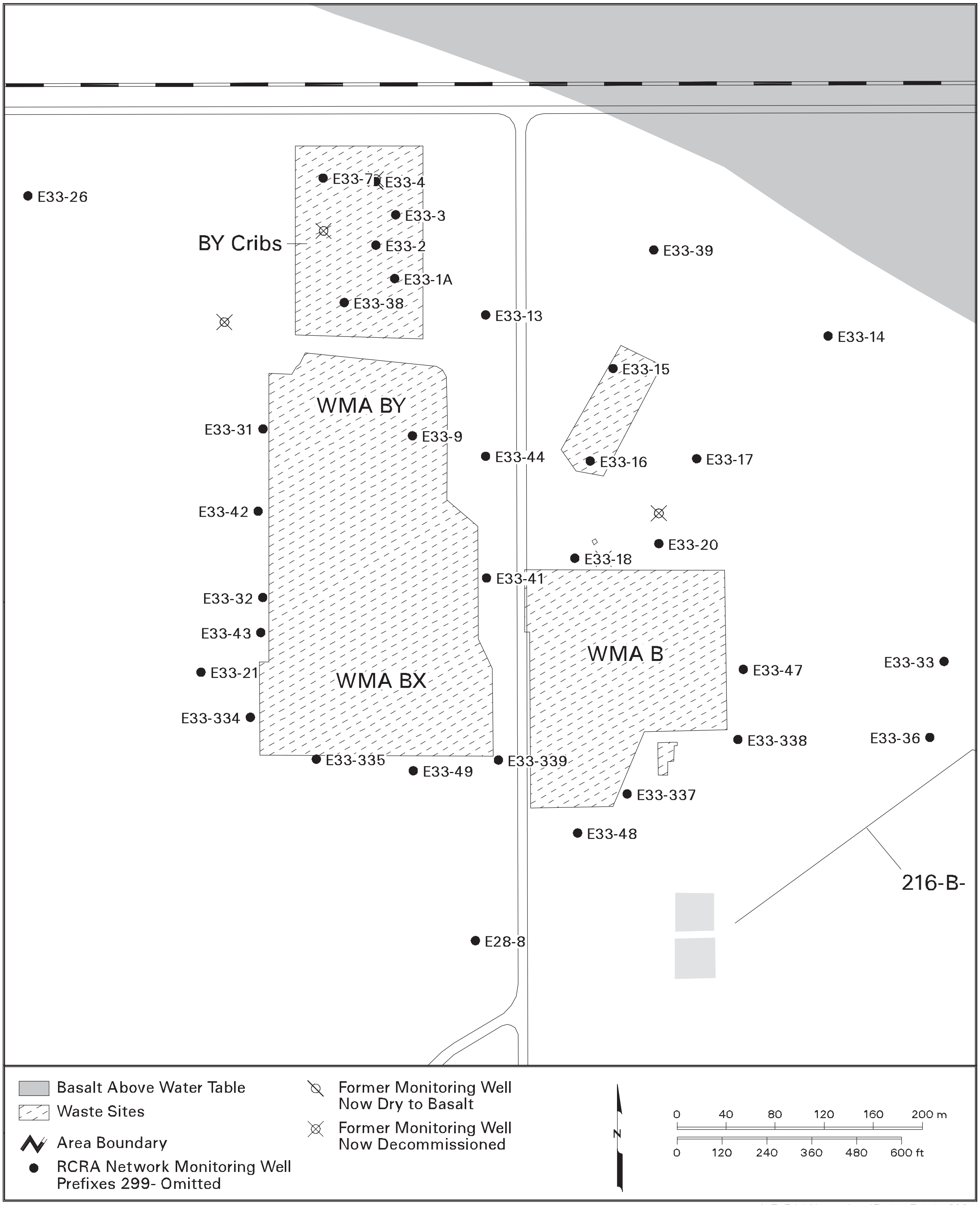

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Figure B.16. Groundwater Monitoring Wells at Waste Management Area B-BX-BY

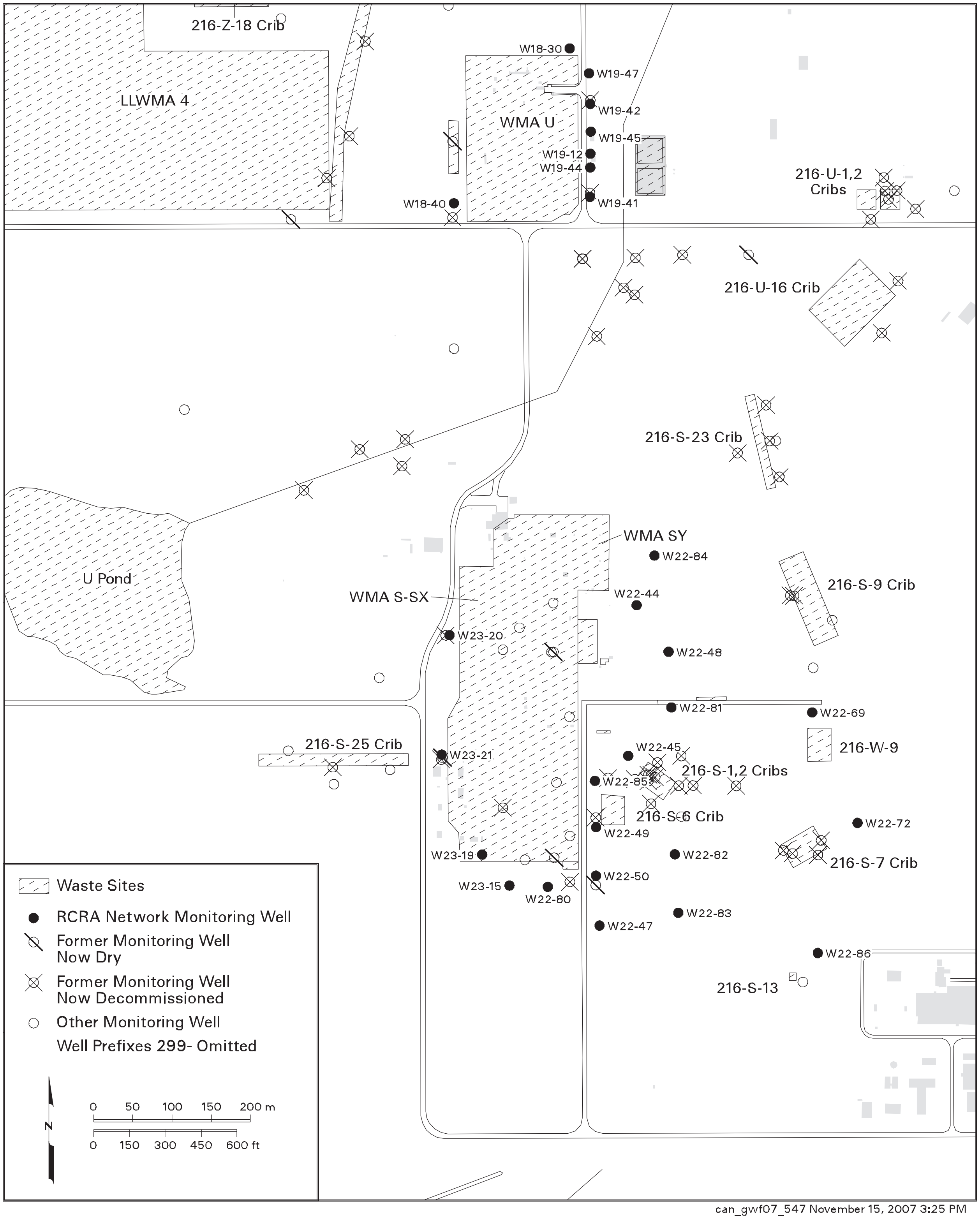

Figure B.17. Groundwater Monitoring Wells at Waste Management Areas S-SX and U

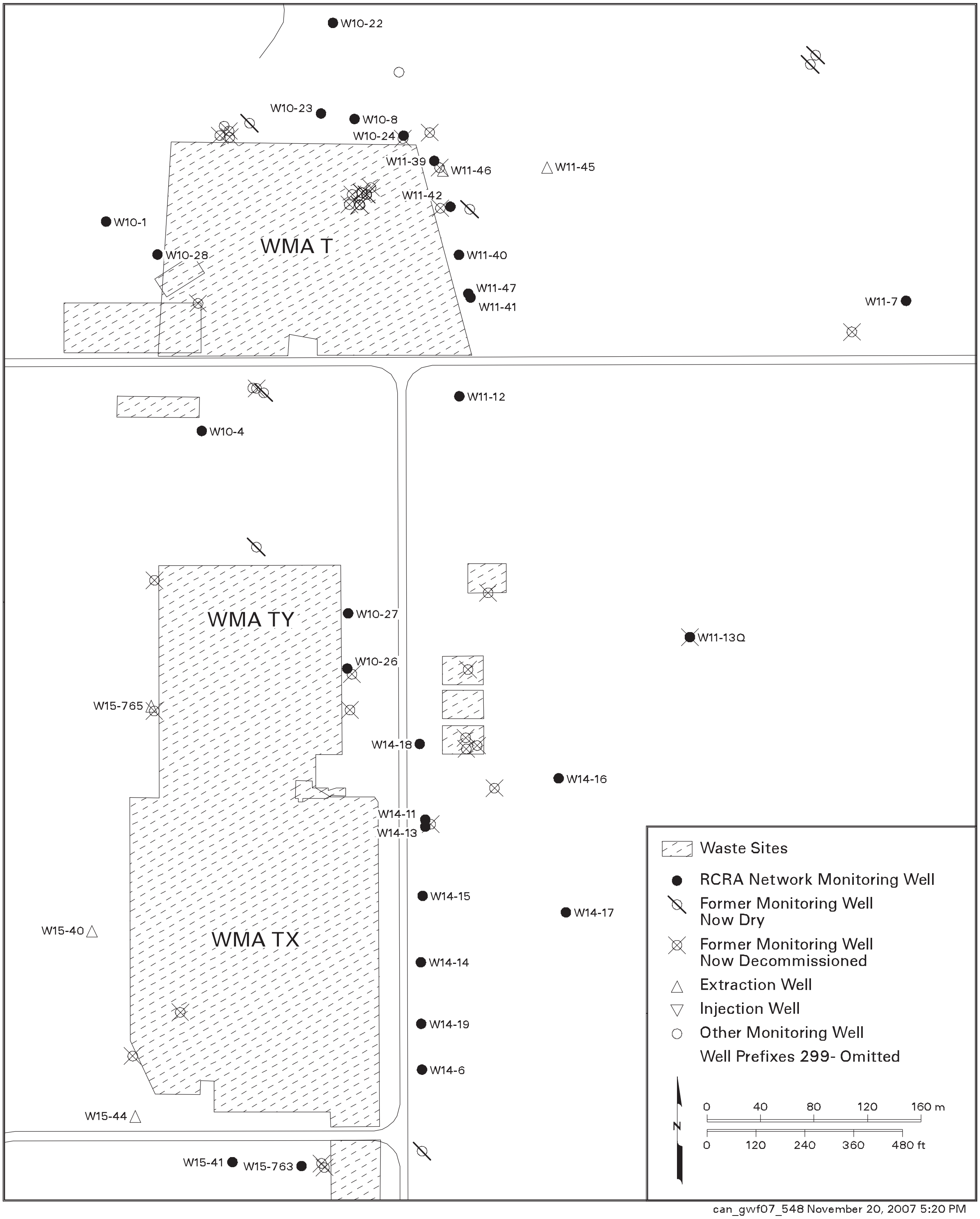

Figure B.18. Groundwater Monitoring Wells at Waste Management Areas T and TX-TY

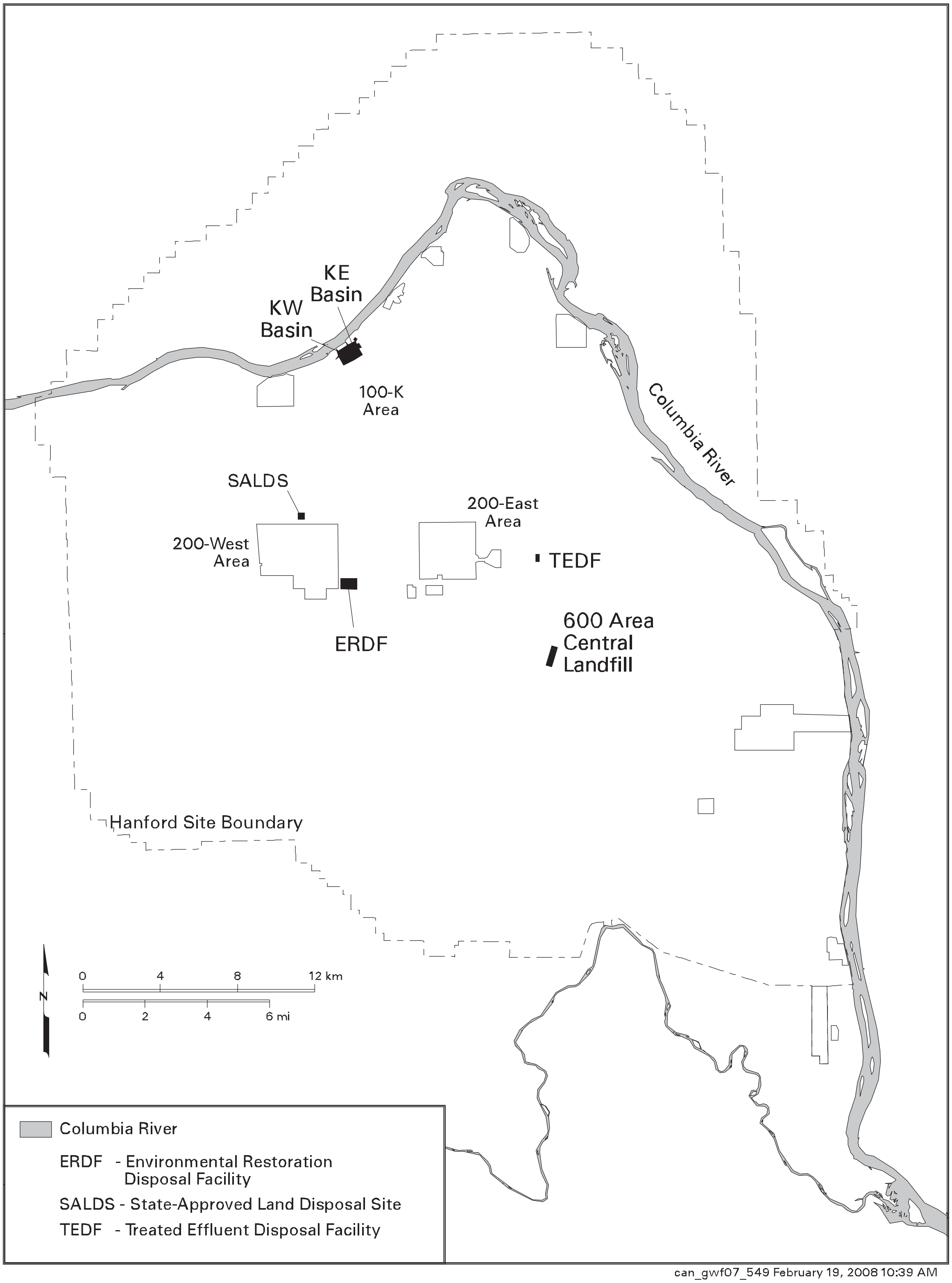

Figure B.19. Regulated Units on the Hanford Site Requiring Groundwater Monitoring

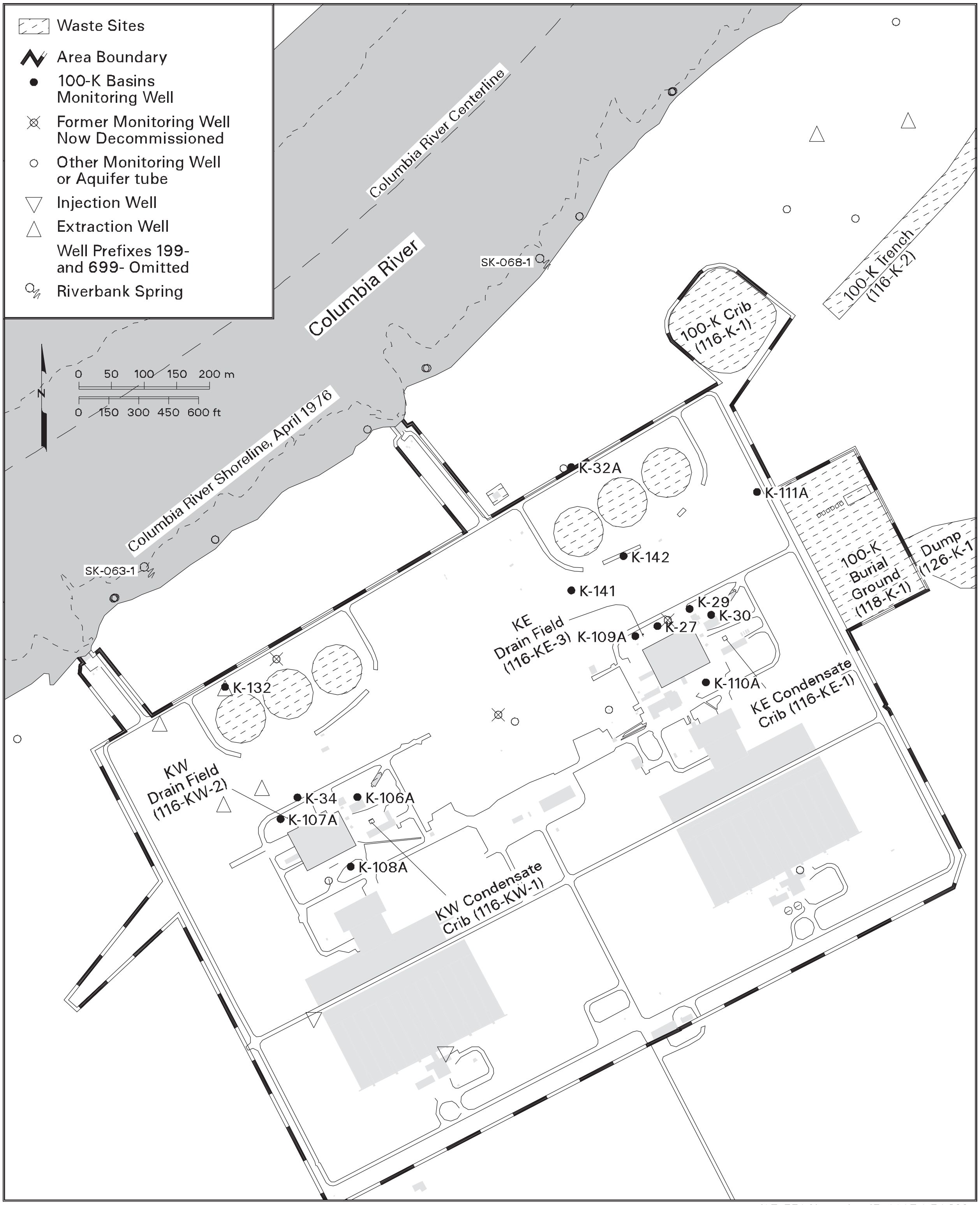

Figure B.20. Groundwater Monitoring Wells at 100-K Basins

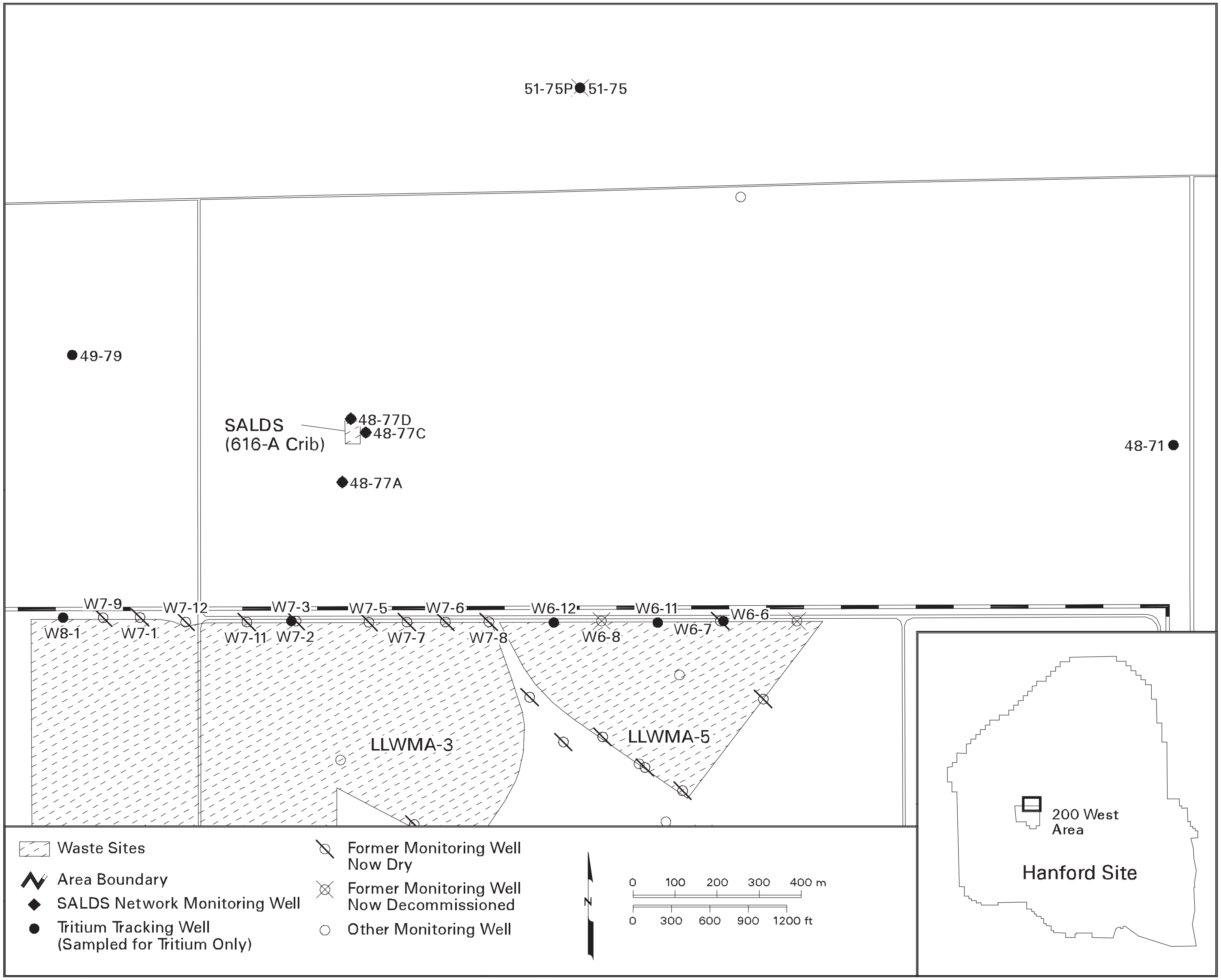

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Figure B.21. Groundwater Monitoring Wells at State-Approved Land Disposal Site

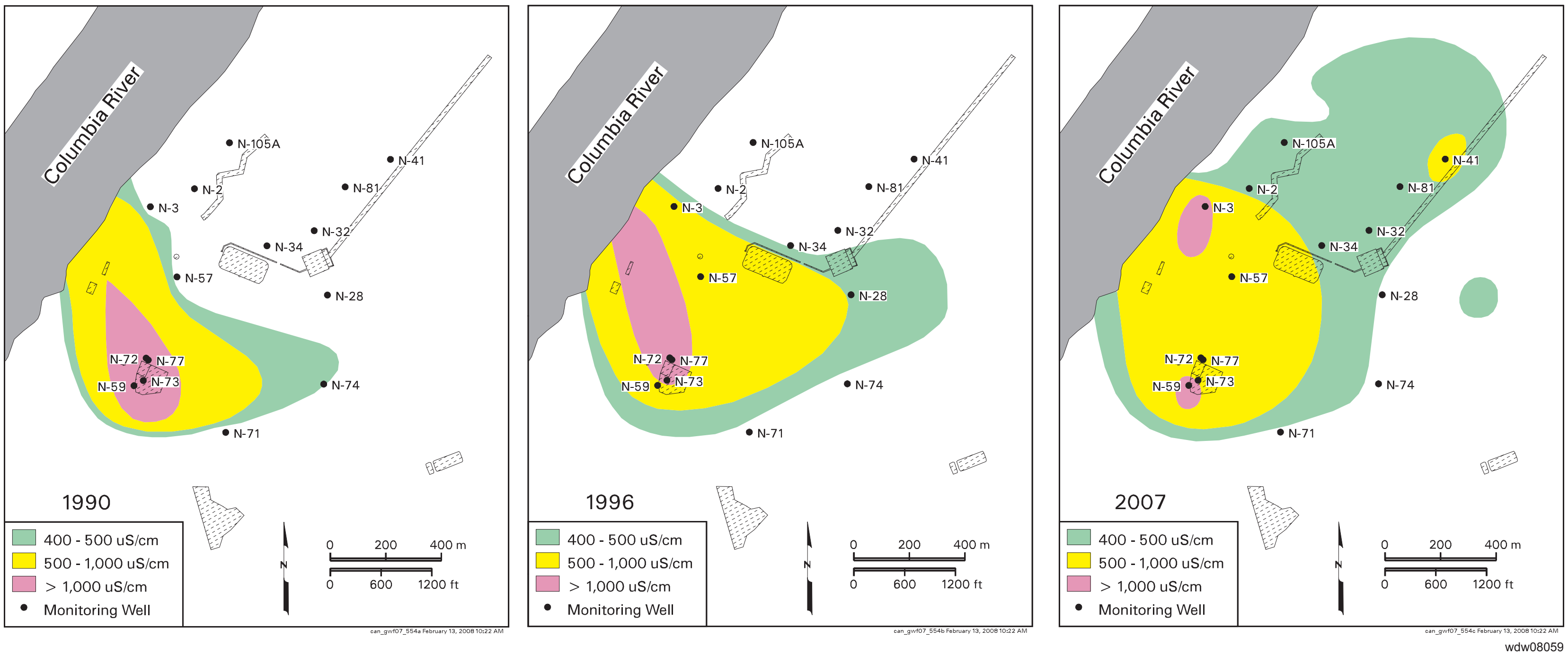


Figure B.22. Average Specific Conductance in the 100-N Area, Top of Unconfined Aquifer, 1990, 1996, and 2007

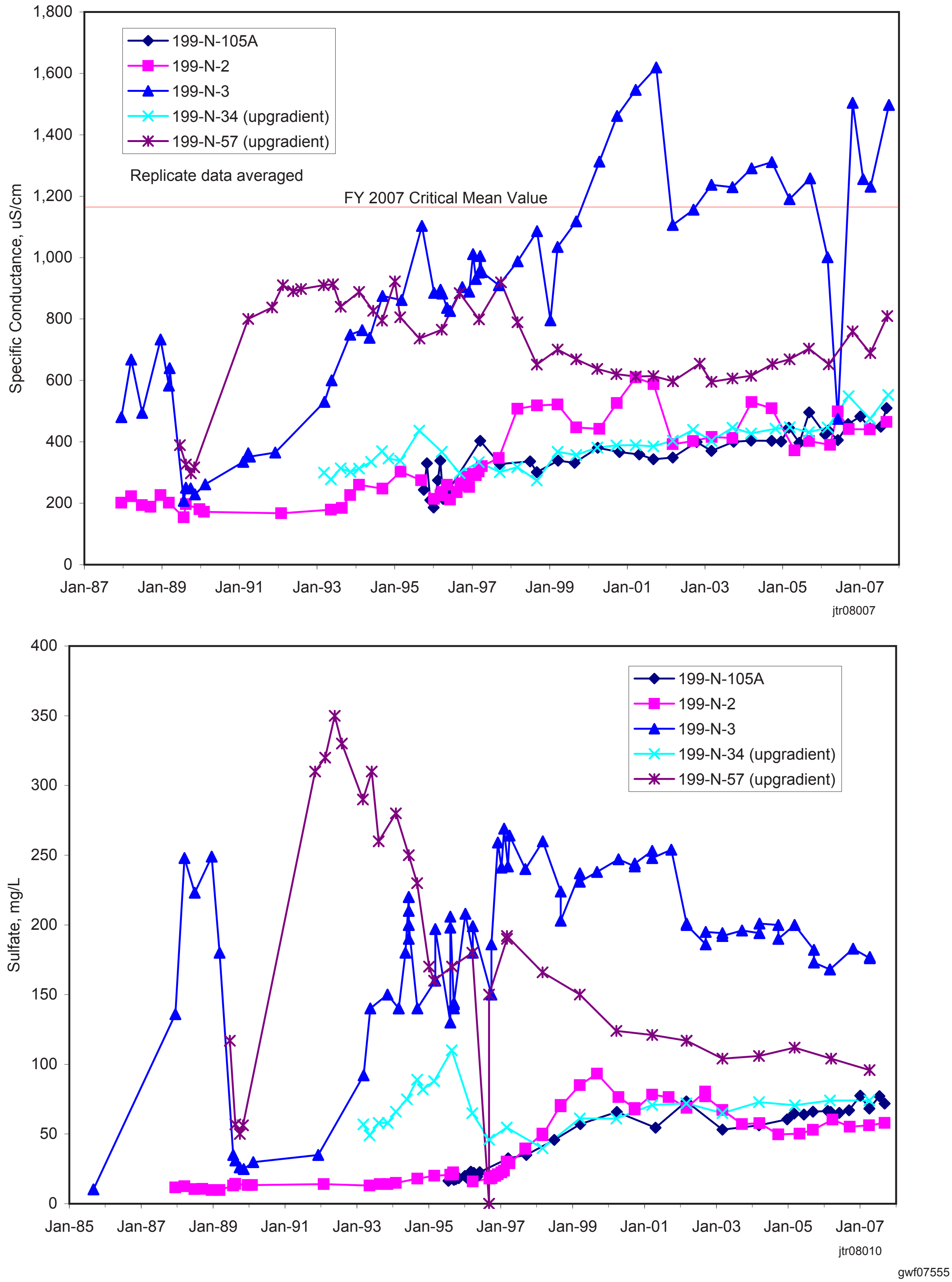
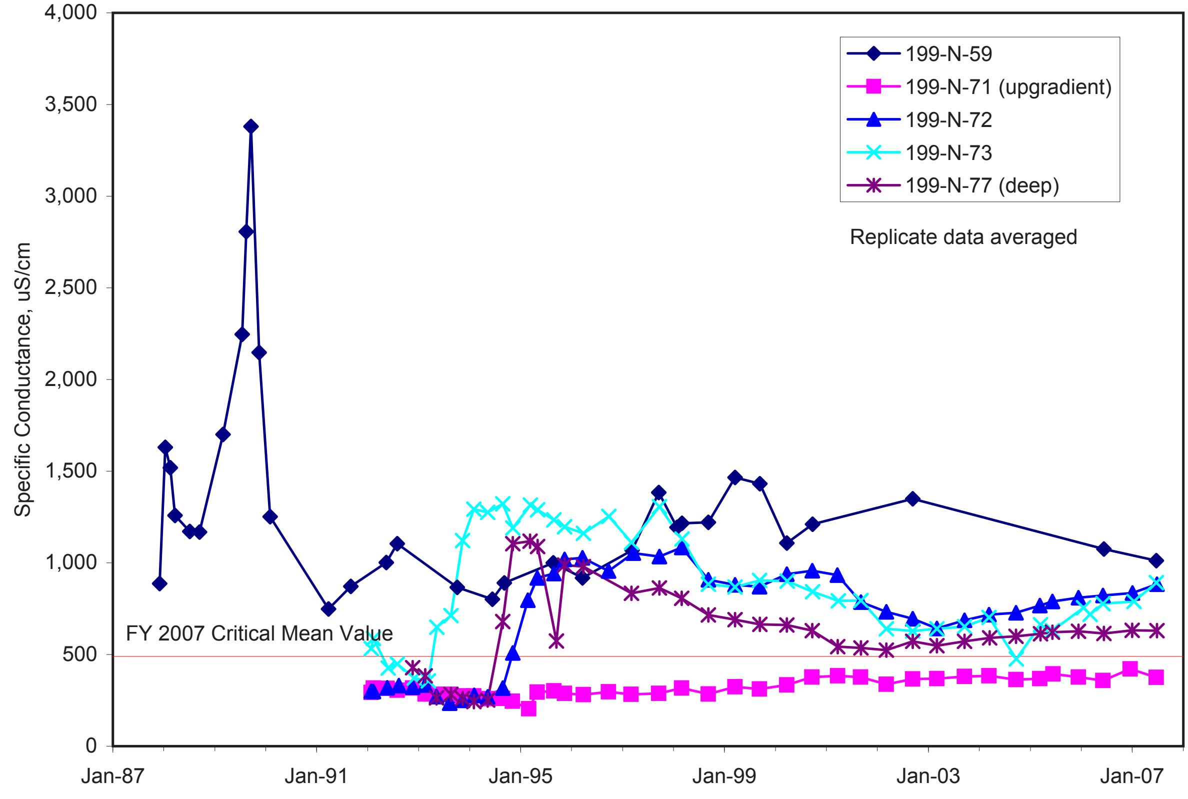


Figure B.23. Specific Conductance and Sulfate in Wells Monitoring 116-N-1 Facility



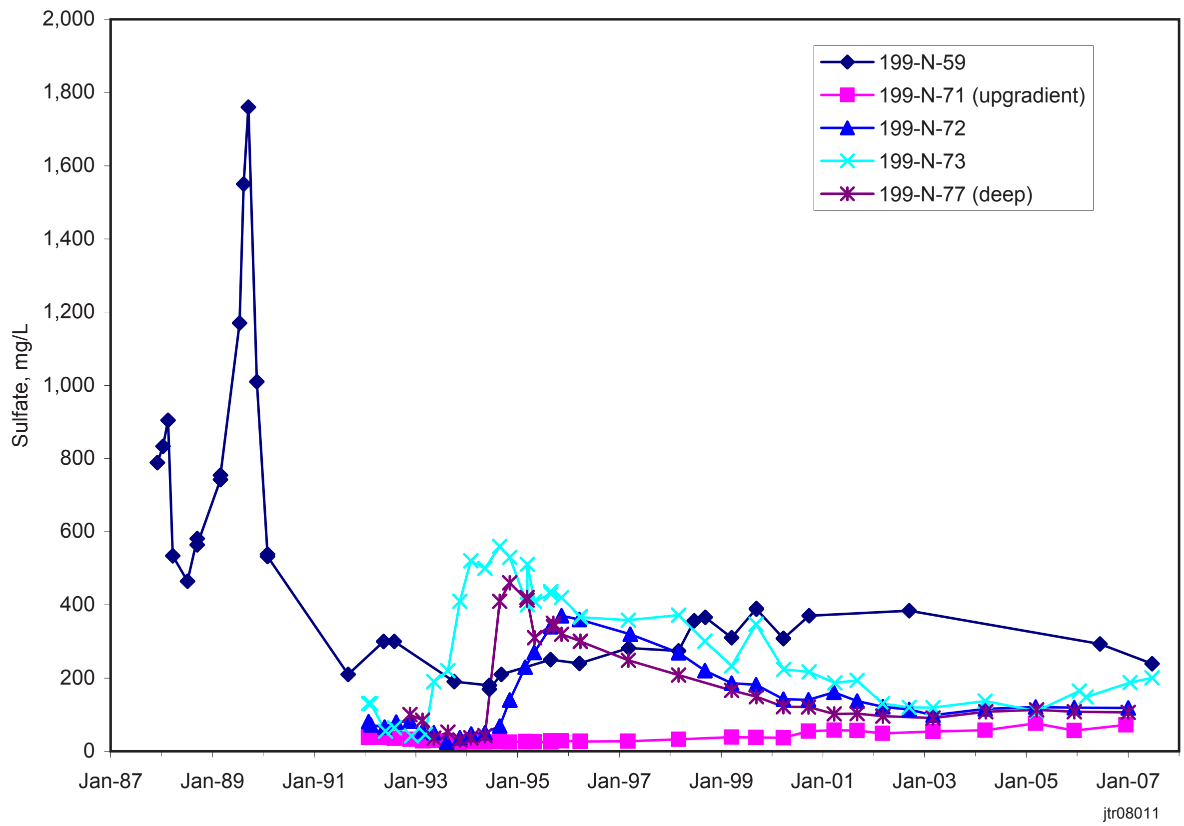


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Figure B.24. Specific Conductance and Sulfate in Wells Monitoring 120-N-1 Facility

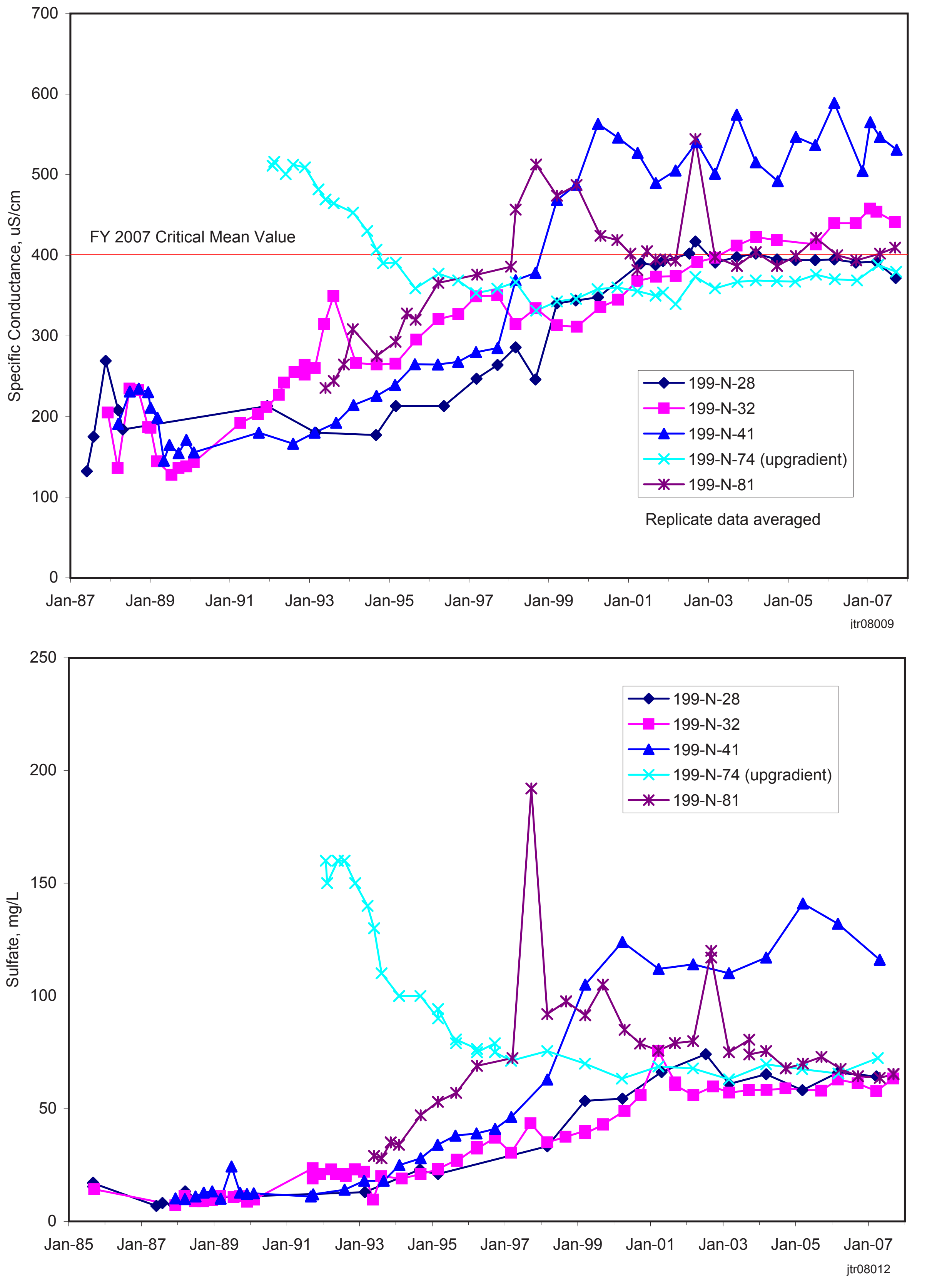


Figure B.25. Specific Conductance and Sulfate in Wells Monitoring 116-N-3 Facility

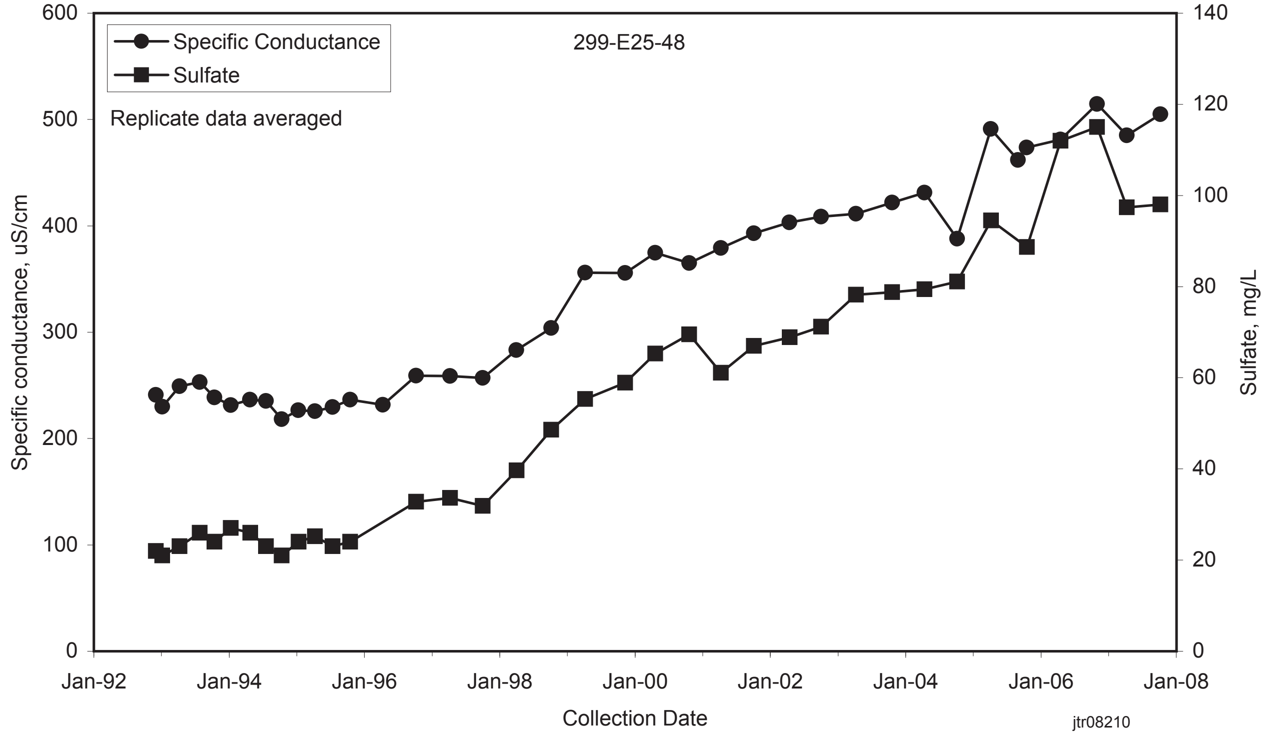


Figure B.26. Specific Conductance and Sulfate in Well 299-E25-48 at the 216-A-29 Ditch

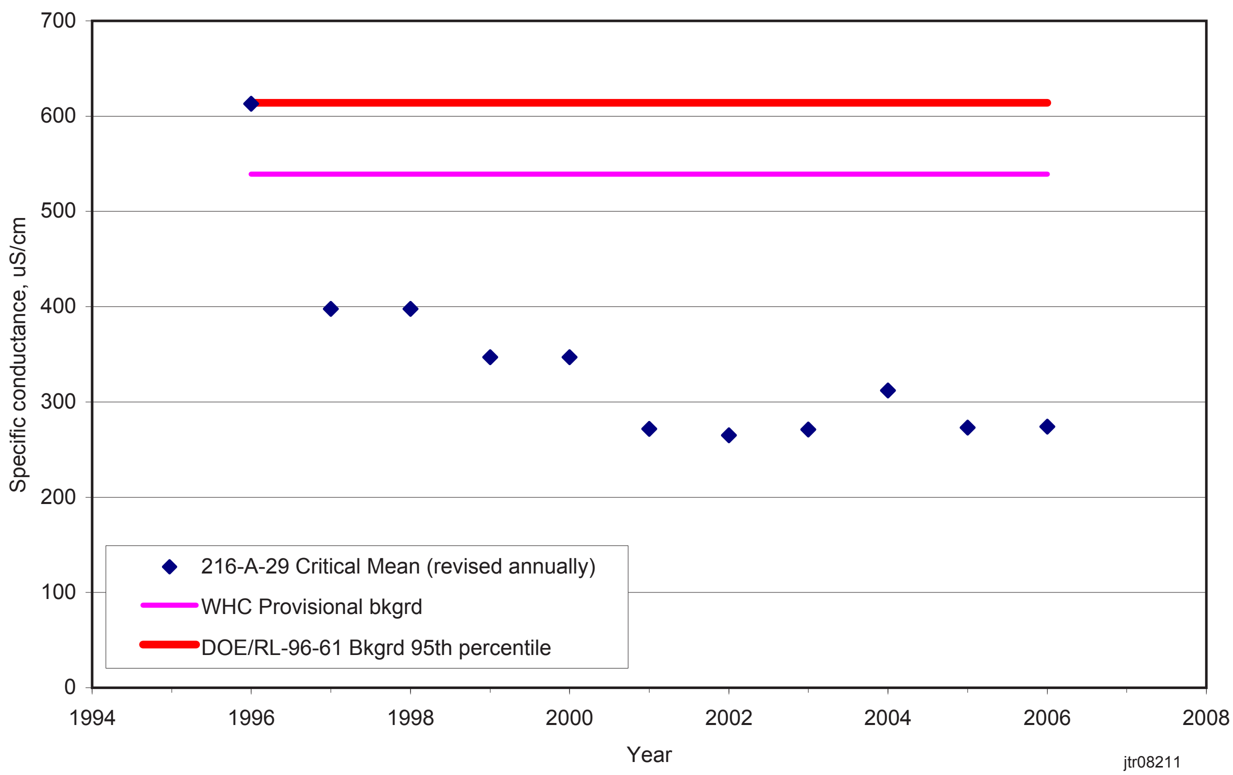


Figure B.27. Critical Mean Values for Specific Conductance at 216-A-29 Ditch Compared to Groundwater Background

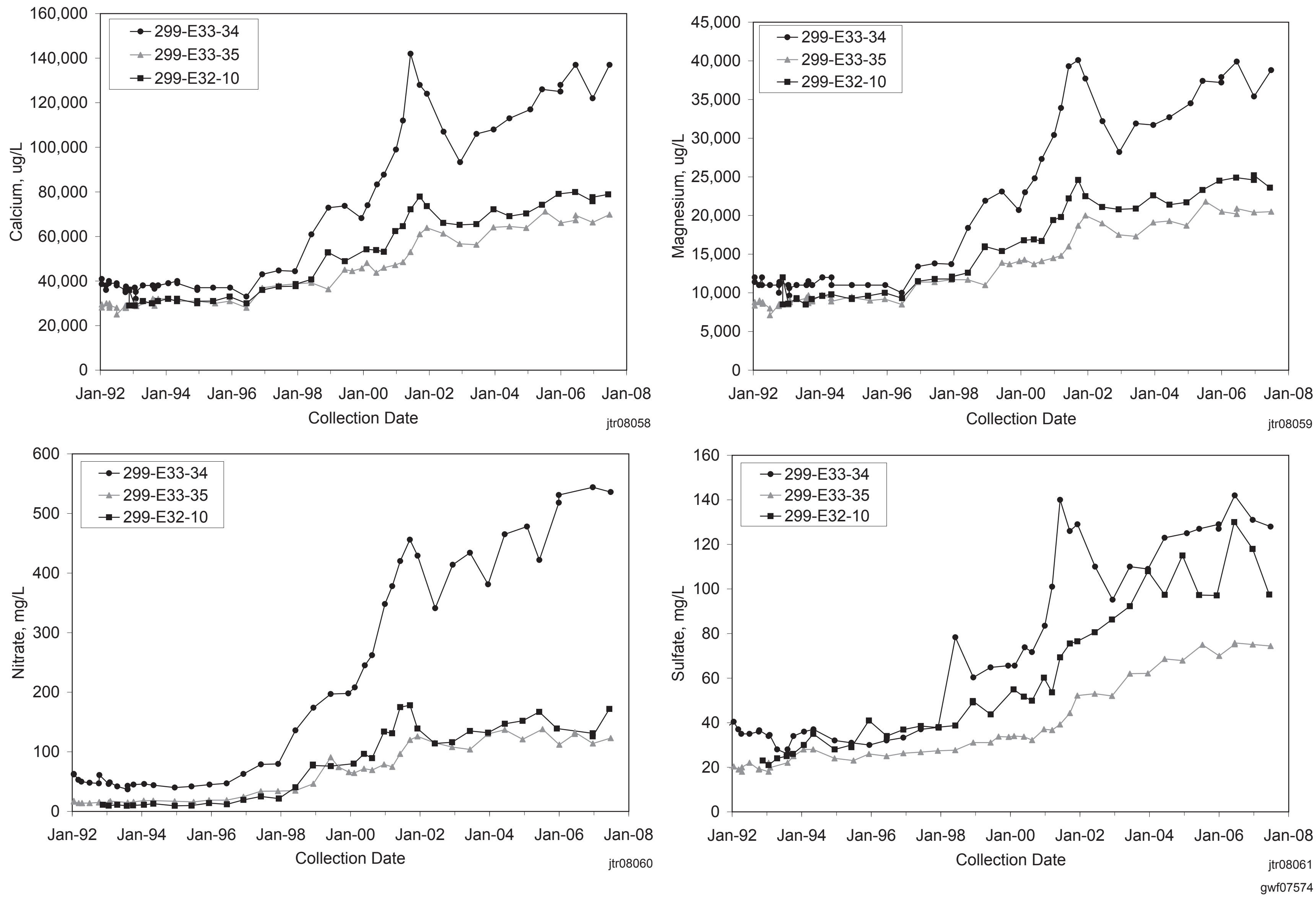
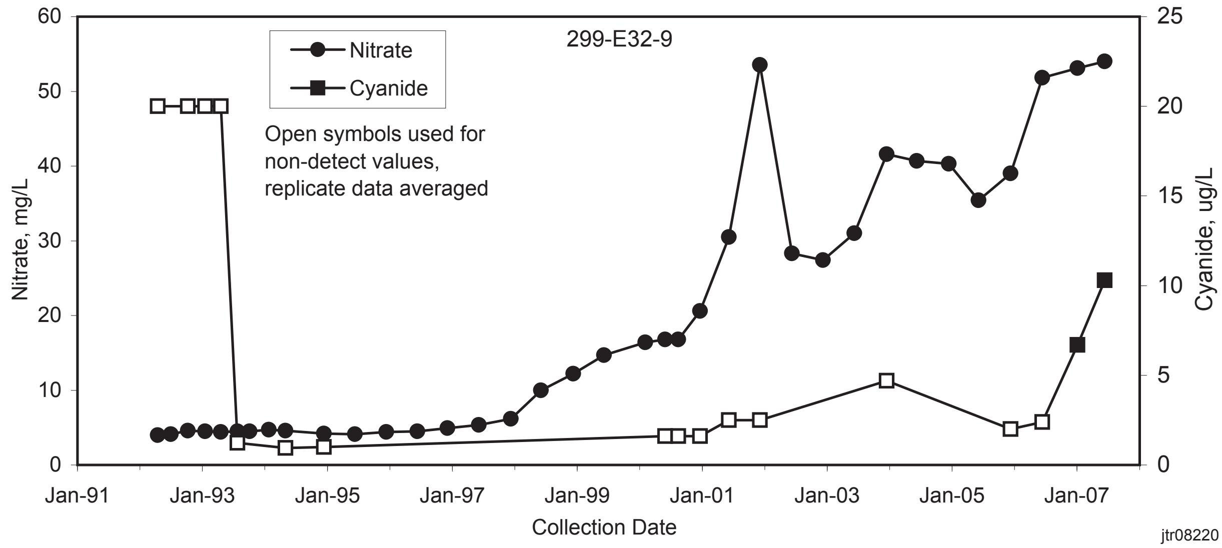
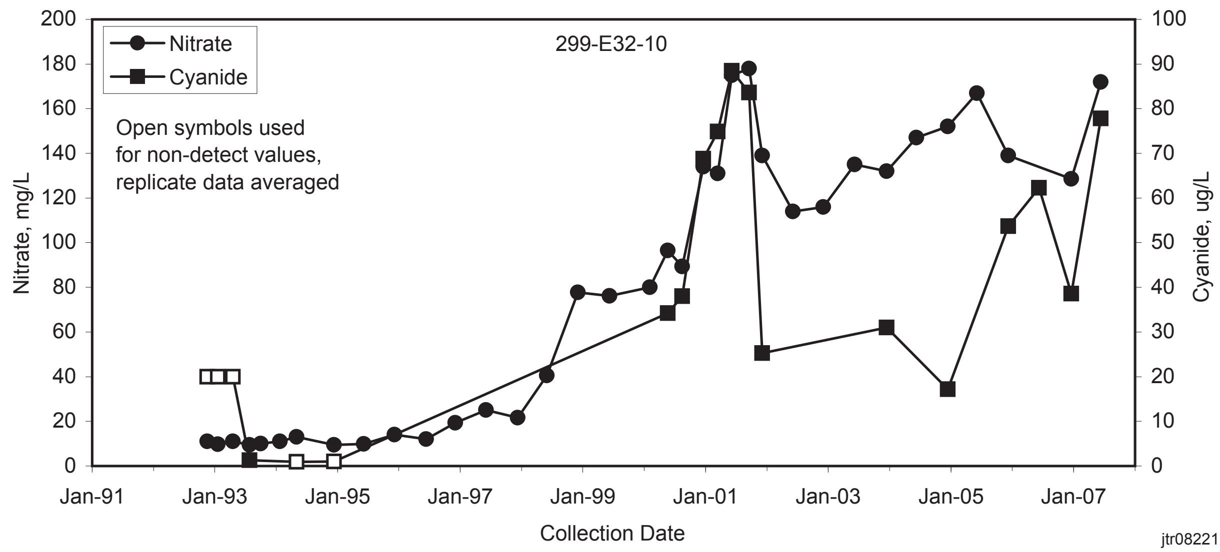


Figure B.28. Calcium, Magnesium, Nitrate, and Sulfate in Wells in the Northeast Corner of Low-level Waste Management Area-1





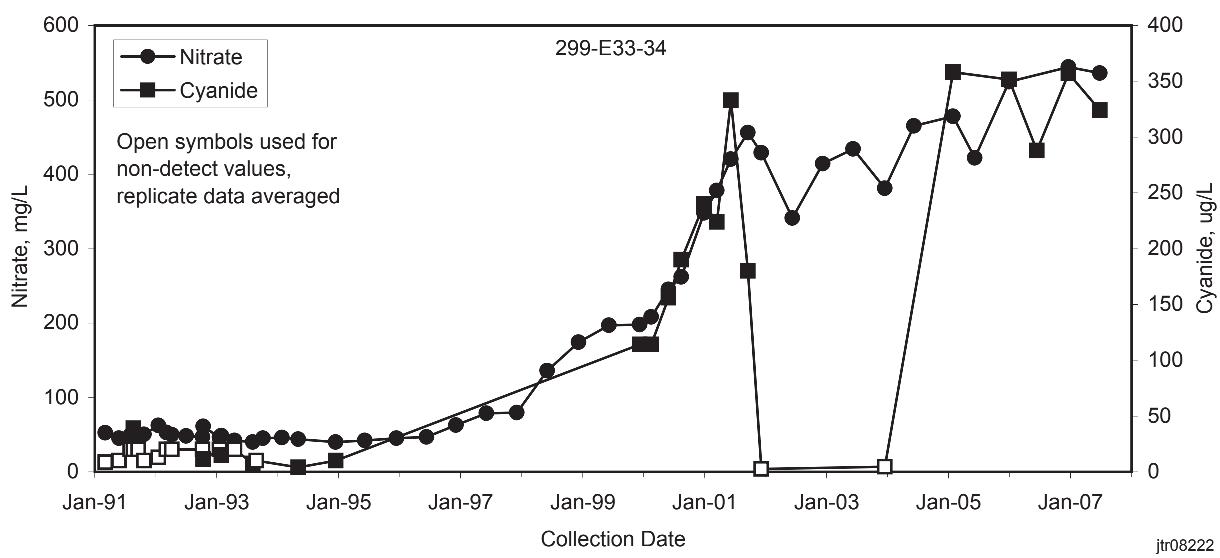


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Figure B.29. Nitrate and Cyanide in Wells on the North Side of Low-level Waste Management Area 1

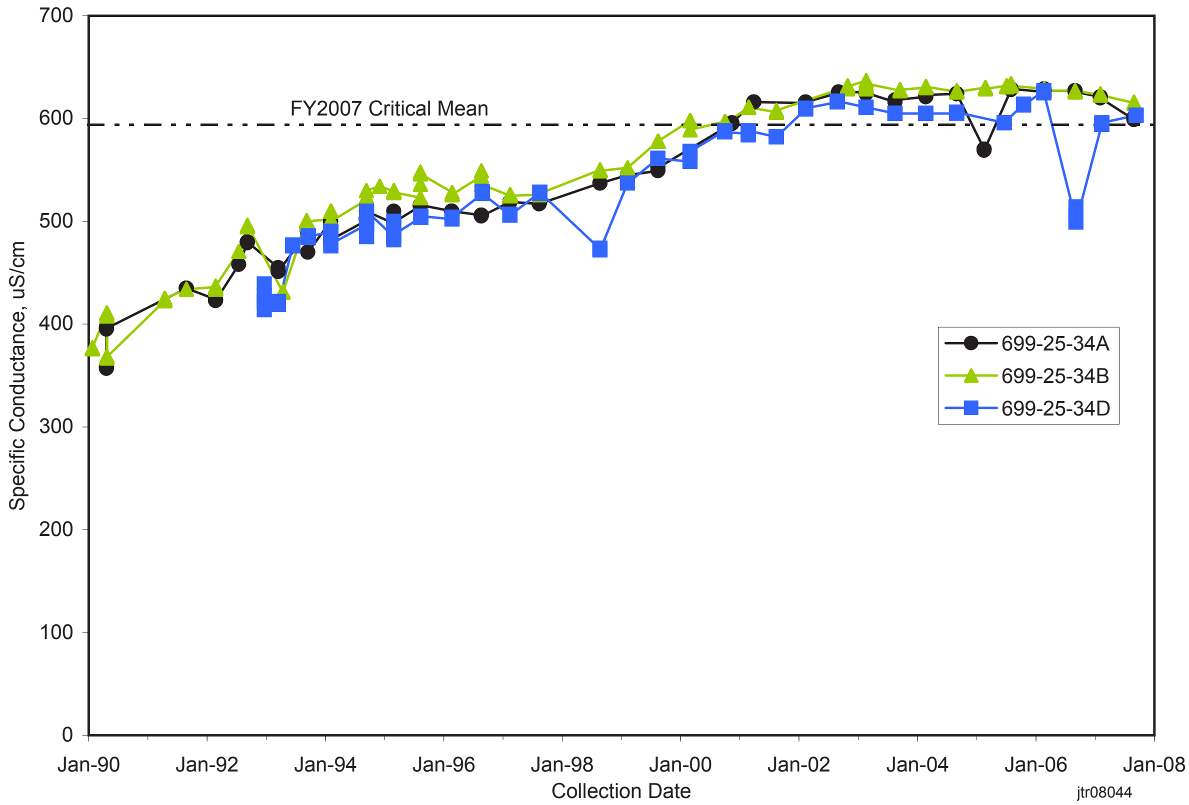

Figure B.30. Specific Conductance at the Nonradioactive Dangerous Waste Landfill

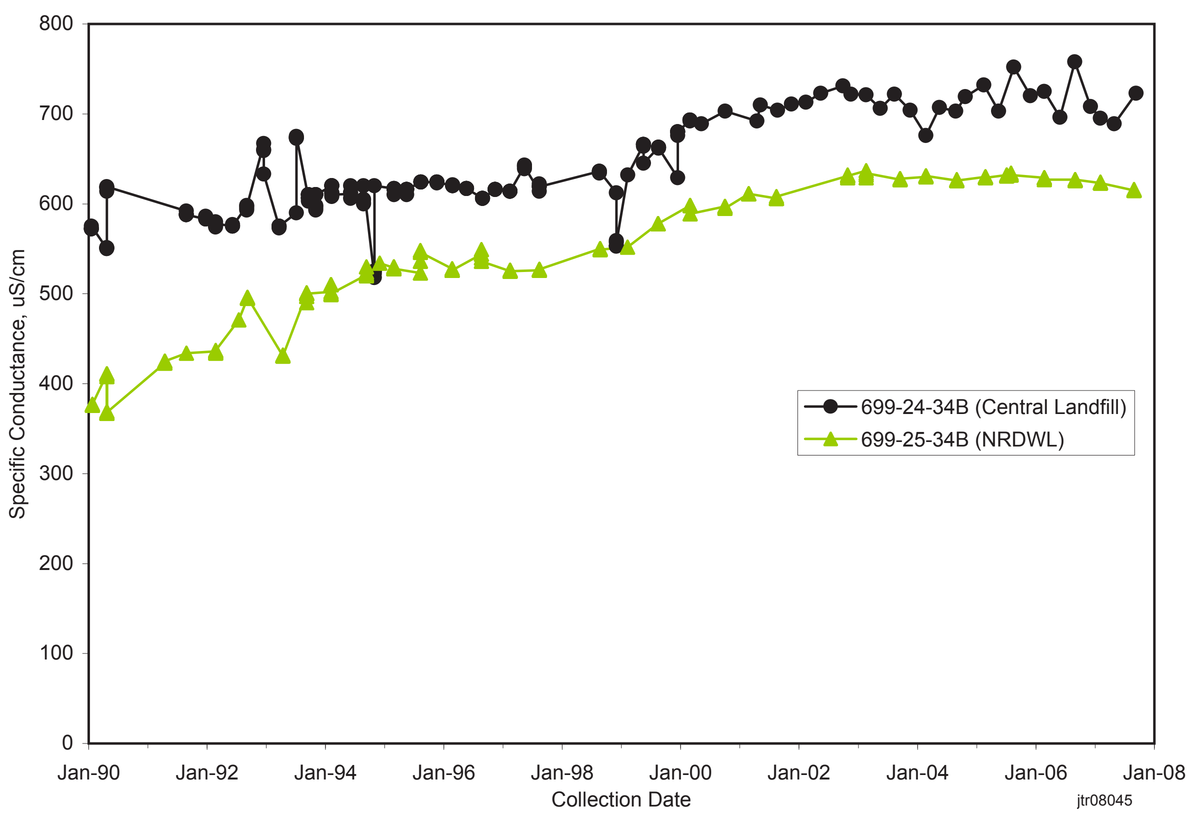

Figure B.31. Comparison of Specific Conductance at 600 Area Central Landfill and Nonradioactive Dangerous Waste Landfill

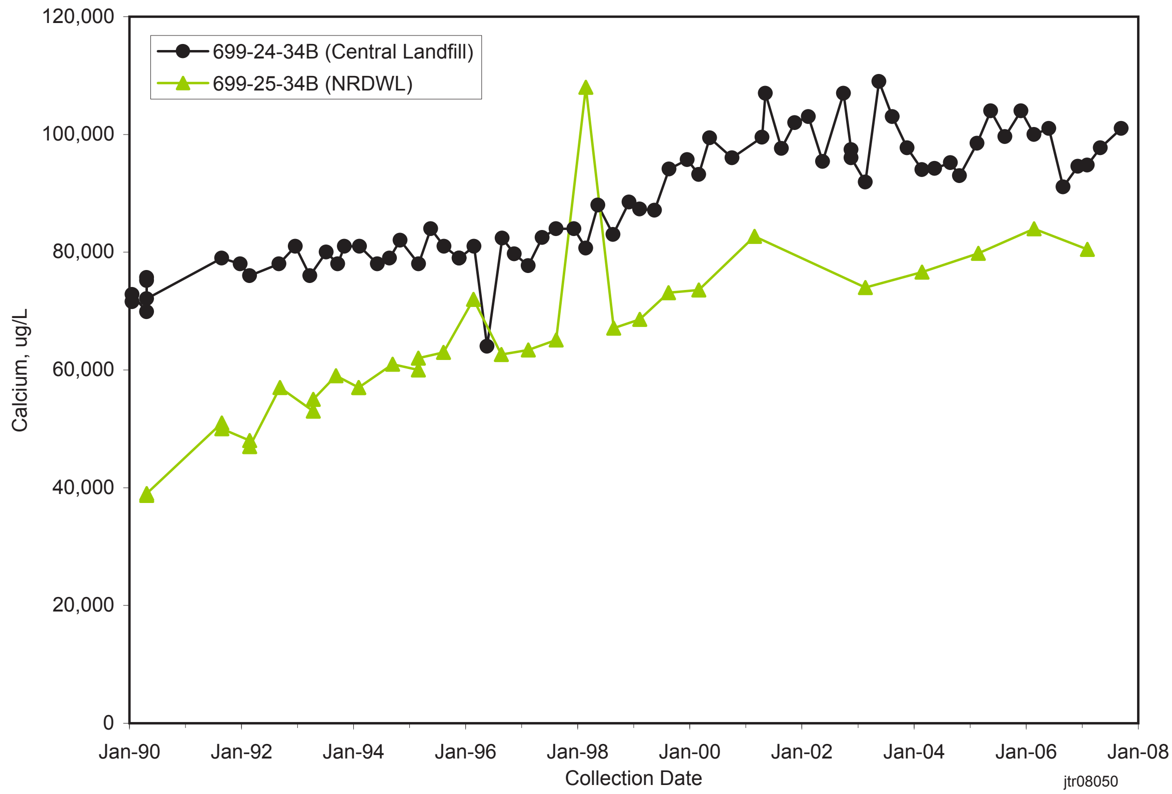

Figure B.32. Comparison of Calcium Concentration at the 600 Area Central Landfill and Nonradioactive Dangerous Waste Landfill

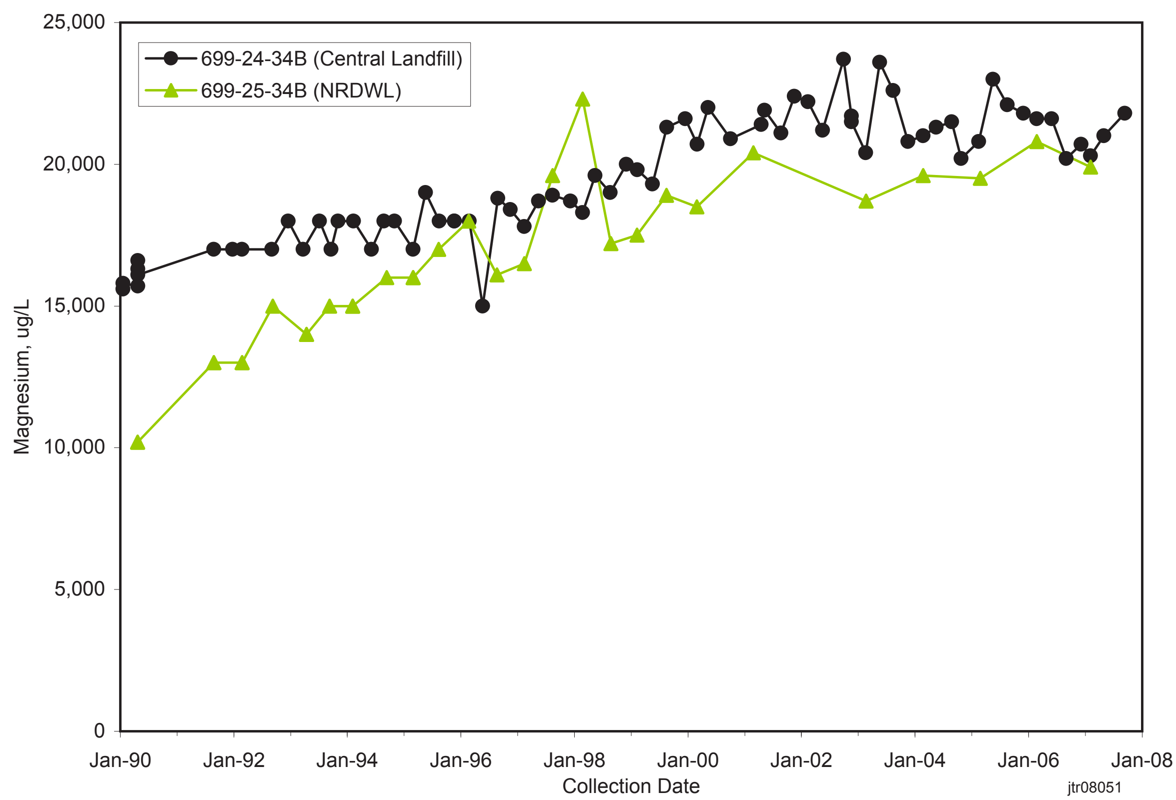

Figure B.33. Comparison of Magnesium Concentrations at the 600 Area Central Landfill and Nonradioactive Dangerous Waste Landfill